Horning Seed Orchard Spring Insect Spray

Environmental Assessment

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Responsible Agency:	USDI - Bureau of Land Management
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Abstract: This environmental assessment discloses the predicted environmental effects of one action alternative and one no action alternative for a proposed insect spray project on Horning Seed Orchard, located in Sections 13 and 23, Township 4 South, Range 3 East, Willamette Meridian. The action alternative would entail aerial spraying for cone insects on specified orchard blocks during Spring 2001 to control seed losses.

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INTRODUCTION

Horning Seed Orchard - Description of Operations

The Horning Seed Orchard (HSO) is located approximately 25 miles southeast of Portland, Oregon near the town of Colton, on the Bureau of Land Management's Salem District. The orchard was initiated in 1964 and consists of 800 acres total with 608.5 acres developed for seed production.

HSO's operations are composed of four categories which consist of:

- Orchard Operations - Tree seed production, tree breeding and preservation of tree parent material.
- Seed Plant Operations - Cone and seed processing.
- Greenhouse Operations - Containerized seedling production.
- Native Species Operations - Native species grow-out beds.

<u>Orchard Operations</u>

Currently there are approximately 248 acres devoted to conifer seed production. The species include Douglas-fir, Noble fir, western hemlock, western red cedar, sugar pine, and western white pine. The seed production orchard units may produce 1,600 to 3,500 bushels of cones annually, depending upon customer needs and crop stimulation success.

In Douglas-fir and western hemlock, cone crops are stimulated using a combination of techniques including girdling, gibberellic acid (GA 4/7) injected into the trees, and calcium nitrate (CaN) fertilizer at 200 pounds of nitrogen per acre applied at the drip-lines. A typical year would involve 200 trees treated with GA 4/7 and 800 trees treated with CaN.

Between the success of stimulation efforts and natural cone crops, an average of 1,000 bushels of cones are harvested annually based upon seed needs and customer requests. Cone crops and seed yield can be greatly reduced from the effects of frost, abortion, and insect pests.

Tree breeding for tree improvement and forest genetics (i.e. height growth, disease resistance and wood density characteristics), involves controlled crosses of known and tested parents. A typical year involves pollen collection and processing and completing 150-200 controlled crosses at Horning to support the Northwest Tree Improvement Cooperative. Tree breeding is expected to be completed at HSO for the Salem District Cooperatives in 2005 and the Coos Bay Cooperatives in 2007.

Vegetation control of established groundcover (i.e. orchard grass and companion mix) for operational safety of equipment, pest control, and fire prevention is accomplished by a combination of livestock grazing (cattle and sheep), mowing, and haying operations. Each form of control is based on tree size, spacing, terrain, and ability to protect crop trees from damage. Livestock owners and hay harvesters perform their services under a Cooperative Agreement. Orchard mowing is accomplished by HSO staff. Approximately 200 acres are grazed annually, 165 acres are hayed, and 90 acres are mowed twice per season. Noxious weed invasion is an increasing problem, which has not been successfully controlled using manual and biological controls.

Orchard roguing, the removing of unwanted and lower performing families of trees, takes place annually. Approximately 2,500 trees are removed each season over nearly 25 acres. Recycling of Group I orchard units began in 1998. This involves removing trees that were established for cone production in the mid 1960's to mid 1970's for interim seed needs until testing and production of the 1st generation seed production orchard units began. A schedule has been established to recycle all Group I orchard units by 2016.

Orchard development typically involves stump removal, subsoiling to approximately 36 inches, discing, and land-leveling. Sowing of grass seed to establish a ground cover crop and planting of grafted seedlings or rootstock. The site preparation is completed in the drier summer months for tree planting in late fall or early winter. Young seedlings generally need irrigation to promote survival during the dry summer months for the first few years until they are well established.

To promote tree health and vigor, Perfection Standard Blend fertilizers are applied according to the Horning Soil Management Plan (Boyer 1994). The specific areas requiring fertilizer treatments and amounts are determined through foliar sampling and analysis. Some fertilization is also required to promote ground cover vigor and control moss.

Breeding and preservation orchards currently occupy approximately 65 acres. Another 106 acres have been cleared and established with ground cover (fallow). These are for development of second generation tree improvement and minor species orchards.

Approximately 191.5 acres are are occupied by structural facilities (Building Compound) or vegetated riparian stream buffers.

<u>Seed Plant Operations</u>

HSO houses a seed plant / extractory which processes an average of 1,400 pounds of seed (approximately 2,500 bushels of cones) annually. Aside from processing the crop produced at Horning, it also processes cones and seed from other BLM orchards and field collections within the districts. As workloads allowed during the last few years, HSO has processed cones and seed for several other state, county, and city agencies. The facility provides state-of-the-art cone storage, seed testing, packaging, shipping, and seed storage services.

Greenhouse Operations

The greenhouse complex consists of two greenhouses, a center-span holding area, a nursery work building, several container storage areas, a loading dock, a pump house, and 500 square feet of cooler space. The greenhouses have 19,000 square feet of growing space which can accommodate 940,800 container seedlings at maximum production figured on 100 seedlings per square foot (using 3 cu. in. growing containers). The holding area can accommodate another 64,000 container seedlings of the same size with 640 square feet of growing space.

The nursery's pure well water provides a neutral base for growing seedlings. Soluble fertilizers providing both macro and micro nutrients required for healthy plant growth are added through an overhead drop-riser irrigation system. This system is regulated automatically and provides specific delivery of fertilizers and pesticides by quadrants. Additionally, watering schedules and bench watering can be used for small specialty lots. The greenhouse is also equipped with a small mist bench area for vegetative propagation. Overhead convection tubes provide heat and good air circulation to promote drying and disease control. The infra-red heat system in House 2 provides unique qualities in heating which facilitate drying and inhibit conditions that promote spread of fungal diseases. Greenhouse 1 uses incandescent and fluorescent lighting to extend photo period and meet special growing conditions for some species. Use of integrated pest management provides alternatives to pesticide use while insuring proper control options, which can be used when predetermined thresholds of damage or infection are reached.

Native Species Operations

Ten acres have been developed for grow-out of native species at Horning. Approximately 0.036 acres are currently in production for native grasses.

Chapter 1- Purpose of and Need for Action

Project Location: The project is located at the Horning Seed Orchard in Sections 13 and 23, Township 4 South, Range 3 East, Willamette Meridian. This is near Colton, Oregon, southeast of Portland. The orchard is positioned on a watershed divide separating the Molalla and Clackamas River drainages. See maps 1, 4, and 7.

The seed orchard is Administratively Withdrawn and was noted as a Public Land Withdrawal under the Salem District Resource Management Plan (BLM 1995). As a result, access to the orchard is limited (It is entirely fenced). The BLM Oregon State Office has indicated that most Northwest Forest Plan Standards and Guidelines do not apply to this administrative site. Clean Water Act, Threatened and Endangered Species Act, and other laws still apply to orchard operations and are considered in this impact analysis.

Background: The Horning Seed Orchard produces seed and seedlings for numerous plant species, but mostly conifers. This is done for internal BLM use as well as for numerous private and government cooperators. In order to meet customer needs for seed production, the orchard must maximize seed crop production and minimize seed loss from pests. An insect control research project was completed at the orchard which helped determine the most effective insect control methods. The outcome of that research provides the basis used to develop the proposed action.

An environmental impact statement covering an Integrated Pest Management Program for the orchard is in progress, but is not expected to be completed until Spring 2002. As an interim NEPA measure, pending completion of the EIS, this Environmental Assessment is being prepared for this proposed action. **The proposed action is limited to a single chemical for use on specific orchard units during the Spring of 2001 only** (See Map 8). If the EIS is not completed in time for chemical treatment in Spring of 2002, this EA will be amended to evaluate the specific orchard blocks needing spray in 2002.

Purpose: The purpose of the proposed action is to spray certain blocks of trees within the orchard to control seed and cone insect pests during Spring 2001 (See Table 1 and Maps 2 & 3).

Need: This proposed action is needed because the orchard has been experiencing periodic loss of seed crops to insect pests. The pests of concern are coneworms (*Dioryctria abietivorella*) and Douglas-fir seed chalcids (*Megastigmus spermotrophus*). If infestation levels warrant control, Asana XL (esfenvalerate) insecticide would be needed for spring spray to control insect pests and protect the orchard's seed crop. Insect sampling would be conducted to determine if infestation levels would be high prior to initiation of any control. If infestation levels are low, control would not be instituted.

Proposed Action: The BLM proposes to spray approximately 29 acres in 7 orchard units as identified in Table 1 and Maps 2 and 3. A detailed description of the proposed action (Alternative 2) under analysis is contained in Chapter 2.

Decision to be Made: Denis Williamson, District Manager, is the official responsible for deciding whether or not to prepare an environmental impact statement, and whether to approve the spring insect spray project as proposed.

Issues: The proposed action was listed in the December 2000 Salem District Project Update, which was mailed to over 1200 addressees. Issues derived from the May 1999 scoping conducted for the Seed Orchard Integrated Pest Management Program DEIS, currently in preparation, are also incorporated in this EA where they apply.

The Interdisciplinary Team (IDT) identified four major issues: human health, water quality, fish and other aquatic organisms, and terrestrial animals. These issues will be the focus of this environmental analysis. Chapter 3 will also contain a discussion of other elements of the environment (i.e. soils, vegetation) which were not identified as major issues but are subject to environmental analysis. This document is tiered to the Pest Management for Oconto River Seed Orchard FEIS (USDA Forest Service 1997). Appendix C of that FEIS, the Risk Analysis, has been drawn upon heavily to quantify the impacts of the alternatives in this assessment.

Issue #1: Human Health and Safety

How would pest control methods, particularly the use of pesticides, affect the health and safety of seed orchard employees, volunteers, cooperators, neighbors, and the public at large? Specific concerns include :

- Potential for effects on human health from spray residue.
- Potential for effects on human health from the consumption of contaminated food (including cooperator's animals) or water.
- Public's desire to receive notification before pesticide treatments occur.
- Adherence to label specifications detailing mixing and application requirements.
- Using properly licensed and certified applicators.
- That adequate training, personnel protective equipment, safety / emergency plans, and information regarding potential hazards are available.

Issue #2: Water Quality
How would application of chemicals affect water quality? Specific concerns include:

- Potential impacts to sensitive beneficial uses of water within the orchard, namely fish and other aquatic organisms associated with the streams, reservoir, and wetlands.
- Sensitive beneficial uses of water downstream from the orchard, in particular, fish and other aquatic organisms and irrigation.
- Potential cumulative impacts of proposed chemical use and existing inputs to the Clear Creek and Milk Creek watersheds.

- Potential for leakage and impacts to both surface and ground water from chemical transport and storage related to the above uses.
- Off site transfer and the effects of this chemical through aerial drift, surface water movement, or ground water movement. How would this movement be monitored, if it occurs?

Issue #3: Fish and Other Aquatic Organisms

How would spring spray of esfenvalerate affect fish and other aquatic organisms within the orchard and downstream? Specific concerns include:

- Following pesticide application, potentially contaminated sediment may affect fish and other aquatic organisms within and downstream from the orchard.
- The potential of direct contact with chemicals for injury or death to fish and other aquatic organisms within and downstream from the orchard.
- Effects on Federally listed threatened or candidate species of fish.

Issue #4 Terrestrial Animals

How would spring spray of esfenvalerate affect terrestrial wildlife? Specific concerns include:

- Potential for injury or death of non-target species.
- Potential for effects on Federally listed species.

Chapter 2 - Proposed Action and Alternatives

Alternative 1 - No Action

Under this alternative, no action would be taken to control seed and cone insects in the affected orchard units during 2001.

Alternative 2 - Proposed Action

Under this alternative, the affected orchard units are proposed to be aerially sprayed with Asana XL(esfenvalerate). Specific application methods are shown in Table 1. If this alternative is selected, the spray would occur in Spring 2001, most likely in April. The window for spraying is only about two weeks long, right after the emergence of female insects. Research has shown that timing is critical for effectiveness. Emergence is determined by trapping insects in the orchard.

Design Features applicable to the proposed action:

The following design features would be applied if this alternative is selected to prevent undesirable effects to adjacent orchard blocks, nearby neighbors / private property, or orchard workers.

1.) Follow guidelines shown on the label for the pesticide being used. These guidelines, required by the Federal Insecticide, Fungicide, and Rodenticide Act, show the list of allowable uses, application rates, and special restrictions for each pesticide. The pesticide would be applied within the prescribed environmental conditions stated on the label. This includes consideration of relative humidity, wind speed, and air temperature when determining the timing of applications relative to drift reduction.

2.) Comply with the orchard's Pesticide Safety Plan.

3.) Continue base-line health testing of workers for exposure.

4.) Prior to pesticide application, notify downstream water users within one-half mile of the project area and adjacent landowners who could be directly affected by accidental drift and water transport from normal operation.

5.) Post Material Safety Data Sheets at storage facilities and make available to workers. These sheets provide physical and chemical data, fire and reactivity data, specific health hazard information, spill or leak procedure, instructions for worker hygiene, and special precautions.

6.) Require appropriate protective clothing for all workers. At a minimum, the type and amount of protective clothing listed on the pesticide label must be used. For esfenvalerate, this consists of long-sleeved shirt and long pants + chemical-resistant gloves + shoes and socks + protective eye wear.

7.) Follow all applicable local, state, and Federal laws.

8.) Use only licensed pesticide applicators. Applicator licensing and training is an important quality control measure. Training and testing of applicators covers laws and safety, protection of the environment, handling and disposal, pesticide formulations and application methods, calibration of devices, use of labels and data sheets, first aid, symptoms of pesticide exposure, and other activities.

9.) Orchard workers who know they are hypersensitive to pesticides would not be assigned to application projects. Workers who display symptoms of hypersensitivity to pesticides during application would be reassigned to other duties.

10.) Post treated areas as "off limits" to discourage entry into treated areas until the spray has dried, unless protective clothing is worn, and entry is permitted by instruction on the pesticide label.

11.) When specific conditions warrant, the orchard manager could implement one or any of the following additional design features to further reduce worker exposure:

- a.) Increase the level of protective clothing worn
- b.) Lengthen re-entry time for workers
- c.) Reduce worker exposure periods to the pesticide
- d.) Reduce pesticide application rates
- e.) Reduce the area being treated on a given day

12.) Assure that equipment used for transport, mixing, and application will not leak pesticides into water or soil. Locate areas used for mixing pesticides and cleaning equipment where spillage would not run into surface-waters or result in ground-water contamination.

13.) At a minimum, stream course and wetland buffers will be established within guidelines prescribed by the pesticide label (See also design features 23 through 28).

14.) Application will not occur on days that rainfall or fog is likely to occur. Additionally, there will be no application of esfenvalerate when rainfall is expected to exceed .5 inches per hour within the three days following application. This is the most reliable forecast window and will avoid the potential of exceeding the infiltration rates of the soil.

15.) Drift of aerially applied chemicals will be monitored during the spray operations using 4" X 5 ½" spray cards to detect the presence of drift and the relative amount. Spray cards will be installed along the perimeter of the treatment area, approximately every 50 to 100 feet in sensitive areas such as along stream buffers. Application techniques would be altered or spray operations would cease if drift were detected.

16.) Monitor temperatures carefully. Avoid spraying during the day when bees are active.

17.) Prior to insecticide applications, mow or graze orchard fields to remove floral components so as to minimize the presence of pollinators, such as bees if they are active, to prevent exposure to the insecticide.

18.) Spray in early morning to allow foliage to dry before pollinators become active.

19.) All chemical loading operations will occur within the orchard building compound. This is more than 800 feet from any of the flowing streams. Assure that equipment used for transport, mixing, and application will not leak pesticides onto the soil of the compound area.

20.) A spill containment kit will be on-site at the orchard building compound. Chemical containers will be kept in plastic drip pans which are large enough to hold the entire volume of each container in case the containers develop leaks.

21.) Procedures outlined in the orchard Spill Prevention and Countermeasure Containment Plan will be followed if there is any spill of esfenvalerate.

22.) Treatment will occur early in the morning when wind is minimal (<6 mph) to prevent drift, and preferably when there is no wind. Wind speed will be monitored on-site prior to and during spray applications. Operations will be suspended if wind speeds exceed 6 mph.

23.) Areas immediately adjacent to no-spray buffers on all units will be treated prior to spraying the remaining portions of any of the units. This way, all of the areas adjacent to the buffers will be treated while the winds are calmest.

24.) The helicopter will treat orchard units adjacent to stream buffers by flying parallel to the buffer for the initial spray fly-over. This will reduce the likelihood of accidental overspray into the buffer.

25.) No spraying will be done over any water bodies in or around the orchard.

26.) Stream # 2a (Orchard Unit B-14) will receive a 200 ft buffer from the initiation point of the stream channel. No spraying will occur in this buffer. This will provide a conservative distance from potential flowing water to avoid drift and increase the distance for capture of any potential sediment and organic material. A silt fence will be constructed around the stream initiation point (culvert inlet) in order to provide further confidence in capturing any material with adsorbed esfenvalerate.

27.) Stream # 2b (Orchard Unit P-12) will receive a 200 feet buffer from the edge of the stream channel. No spraying will occur in this buffer. This will provide a conservative distance from flowing water to avoid drift and increase the distance for capture of any potential sediment and organic material.

28.) All other flowing streams will receive buffers of greater than 200 feet by virtue of the existing vegetative buffers. No spraying will occur in these buffers. This will provide considerable opportunity for capture of any sediment and re-introduction of potential surface runoff into organic and soil material.

29.) Infiltration of rainfall into the soil and avoidance of potential runoff will be promoted through use of aerating equipment in the orchard blocks proposed for and prior to application.

30.) If rain has preceded the intended application window, units will be checked for their infiltration capacity. Application will not occur if soils are in a saturated condition.

31.) Water quality monitoring for detectible concentrations of esfenvalerate will be conducted immediately before, and after the aerial spray. This will be done in channels 2b, 5a and 6a. The results of this monitoring combined with the results from the spray cards should provide evidence of the immediate impacts from any potential drift. If any rainfall events occur after the spray project that result in surface runoff (during Spring), runoff and sediment sampling will be conducted with the intent of validating the esfenvalerate modeling and impact assessment. This data, along with a proposed long-term monitoring program, will be included in the Integrated Pest Management EIS.

Alternatives considered but not evaluated

Ground Spray Only

Under this alternative, the affected orchard blocks would be ground sprayed with Asana XL (esfenvalerate). Specific application methods are shown in Table 1.

This alternative was not further evaluated because the height of the trees in the orchard blocks to be treated are impractical to treat from the ground. Ground application treatments are appropriate only when trees are less than 30 feet tall. Cones typically develop in the upper third of the tree canopy and ground application methods are ineffective at reaching these areas when trees are taller than 30 feet. Trees within treatment units B34 and B14 are about 70 feet tall and trees within units P11, P12, P13, P30, and P33 are 40-45 feet tall. The quantity of insecticide needed to get appropriate control on these large trees would be unreasonable and would increase the impacts to an undesirable level (Table 1). Although potential for drift may be reduced, the potential for higher concentrations of Asana in runoff is significantly higher due to the higher application rates. In addition to these environmental concerns, the rate of application would not allow for complete coverage of the orchard blocks within the time window required.

Other Insecticides

Dimethoate, an alternative chemical for use in controlling seed and cone insects, is used primarily with ground based application. Dimethoate is not proposed for use because the label for the present formulation of dimethoate (Digon 400) does not allow for aerial application in seed orchards. Ground application of dimethoate is not applicable due to the height of the trees that need treatment, as noted above.

Other Treatments

Two mechanical treatments have been tested for their effectiveness in controlling seed and cone insects. Mechanical vacuuming removes catkins from the ground in an attempt to reduce overwintering habitat for insects. Vacuuming is not an operational treatment at this time. This treatment targets only one of the seed and cone insects that may be present at the orchard and its effectiveness has not been proven. Another mechanical treatment is called sanitation harvest. With this treatment, all the unused cones are physically removed from the trees to remove the habitat for the seed and cone insects. This treatment targets only one of the seed and cone insects that may be present at the orchard and is presently cost prohibitive. A third alternative is the use of female insect pheromones to attract male insects to traps. This alternative is presently in a developmental stage and is several years away from being available operationally.

Table 1 Application Methods for Esfenvalerate -Asana XL (8.4a% Esfenvalerate as a liquid)

Application Method	Location	Application Volume	Typical Application Rate (a.i.)	Maximum Label Application Rate (a.i.)	Total Cumulative Area Treated (per year)	Proposed Treatment FY2001	Application Date(s)* Used in Modeling
Ground Sprayer (high volume) *Alternative Considered but not Evaluated*	Individual Trees in the Following Orchard Units: B34 P11 P12 P13 B14 P30 P33	5-10 gal/tree	0.003 lb/tree	1.6 lbs. /acre/year	1,000 trees (1 application)	300 trees (150-300 gallons)	Not Modeled
Aerial Spray *Proposed Action*	All of the Following Orchard Units: B34 P11 P12 P13 B14 P30 P33	10 gal/acre	0.19 lb/acre	0.19 lb/acre	50-150 acres (1 application)	29 acres (290 gallons)	April 15

* Represents the typical range of dates on which treatments may actually occur.

Chapter 3 - The Affected Environment

Description of Orchard Operations (See Introduction to EA)

Soils

Soils at the Horning Seed Orchard are basically deep and well-drained, formed primarily in material derived dominantly from basalt (Gehrig 1985). The following provides a description of the primary soil identified in the Horning Seed Orchard. Its characteristics are further listed in Table 2.

Jory Silty Clay Loam - This deep, well-drained soil is on the hill slopes throughout the orchard and includes nearly all the managed lands. It formed in colluvium derived mainly from basalt. Typically, the surface layer is a dark brown silty clay loam about 7 inches thick. The upper 6 inches of the subsoil is dark reddish brown silty clay loam. The next 30 inches are dark red and yellowish red silty clay. The substrate down to 60 inches plus is dark reddish brown and dark red silty clay. Permeability is moderately slow. Available water holding capacity is 9 to 11 inches. The average site index for Douglas-fir on this soil is around 155. The main limitation for tree growth is a high susceptibility for compaction.

Typically for the soil described above, organic matter in the surface soil ranges from two to eight percent by weight. The surface soil pH for the soils in the orchard ranges from 5.1 to 6.0. The rooting depth for most trees and grasses in the orchard is approximately 24 inches. Although the hazard of erosion may be severe if soils are exposed, most of the orchard is covered in a thick mat of perennial grasses with a tree overstory. Little to no erosion is expected under these conditions. Infiltration rates (water moving into soil from the surface) generally range from .6 - 2 inches per hour which generally exceeds the rainfall intensity during the winter period. Compaction of the surface soil can reduce infiltration rates. These soils are generally susceptible to compaction and orchard units which have received intensive managment (eg. tractor use) are likely to reflect some level of compaction in the upper 6 inches of the soil. Infiltration rates can be increased through aeration management.

Table 2 Soil Characteristics at Horning Seed Orchard

Soil Series	Units Located	Depth (inches)	Slope	Surface Rock	Management Considerations
Jory Silty Clay Loam	Seed Orchard	60 +	2 - 15	< 10 % usually	Compaction, Erosion

Soil Series	Depth Of Surface Horizon	Permeability	Texture	Depth to Water Table	Soil Ground - Based Operability Risk Class
Jory Silty Clay Loam	7 Inches	Moderate (surface soil) to moderately slow (subsurface soil)	Silty Clay Loam	> 6.0 Feet	Moderate to High

Soil Series	Site Potential	Runoff	Hazard of Compaction	Tolerance to burning	Hazard of Erosion
Jory Silty Clay Loam	Site Class 2	Slow to Medium	High	Moderate to High	Slight

Soil Series	Hydrologic Soil Group	Detachability	Available Water Holding Capacity (total) (inches)	Available Water Holding Capacity (top 20 inches) (inches)	Bulk Density
Jory Silty Clay Loam	C	0.24 - 0.28	9 - 11	3.5 - 4.0	1.2 - 1.5

Group C denotes soils with a slow infiltration rate when thoroughly wet. These soils either have a layer that impedes downward movement of water or have a moderately fine to fine texture. These soils have a slow rate of water transmission.

Erodability Ratings are Based on K and Slope (From Washington DNR Watershed Analysis Handbook (Version 4.0)

Slope Class (Percent)	K < 0.25 Not Easily detached	0.25 < K > 0.40 Moderately Detachable	K > 0.40 Easily Detached
< 30	Low	Low	Moderate
30 - 65	Low	High	High
>65	Moderate	High	High

Water Resources

The climate affecting the water resources at the Horning Seed Orchard (HSO) can be described as variable, due to the influence of both the Pacific Ocean and the Columbia Gorge. In general, the area experiences cool, wet winters dominated by rainfall, followed by warm, dry summers. Rainfall is extremely light during the summer. During the rest of the year, it follows frequent Pacific storm patterns, especially during the late fall and winter. Weather station data from Estacada (5 miles away, 410 ft. elev.) indicates that for 29 years of record there is an average of 59 inches of precipitation, with approximately 75 percent of the total precipitation occurring from October through March. Average monthly precipitation and days of measurable precipitation are provided in Table 3.

The elevation at the HSO ranges from 900 to 1,100 feet above sea level. Although snowfall can occur during winter cold fronts, this elevation is considered to be below the zone of transient snow influence. The average annual snowfall in Estacada is about four inches; the average frost-free period ranges from 165 to 210 days. The average maximum and minimum daily temperatures in April are 60ºF and 39ºF, respectively. The prevailing wind is from the northwest; however, strong winds from the east and northeast gorge area can occur any time of the year. During clear weather in April, little to no wind can be expected in the early morning, changing to measurable upslope winds in late morning and afternoon.

Groundwater Resources

Limited information is available concerning the groundwater aquifer below the HSO. General geologic maps of the area (USGS, Map I323) indicate the dominant underlying geology is composed of basalt and andesite from the Boring Lava flows. During the Pleistocene, these basalt flows were veneered with sediments and erratics from flooding and subsequent erosion and depositional events. These processes have left materials below the rolling topography which have given variable permeability and uneven depth to zones which would act as aquifers. In addition, because of folding and faulting, the basalt is less a single aquifer than it is several small, unconnected aquifers (OWRD 1992).

Storage of water in the basalt is limited. It is likely that most water accessed by wells in the area is from above the basalt contact. Records from well logs stored at the Oregon Water Resources Department (OWRD 1999a) indicate that there are a total of seventeen domestic wells in Sectionss 13 and 23, with depths ranging from 53 to 155 feet. The average “first water” in the bore hole for these wells was noted at approximately 102 feet. Once completed, the average static water level in these wells is approximately 51 feet. There is one domestic well on the orchard property. It has a static water level of 10 feet from the ground surface, with a yield of four gallons per minute. In the drill log for this orchard well, “first water” was noted at 53 feet.

The direction of deep groundwater flow is unknown and cannot be assumed to follow surface topography. Boyer (1994) suggested that the concave topographic positions (generally areas surrounding stream channels) of the orchard could contain more coarse material than the convex positions. These may be a result of recent geologic erosional processes that have removed the fines (clays and silts) and left the coarser material behind. Permeability and lateral flow of water to the unconfined groundwater associated with wetlands and streams could be augmented due to the coarse materials in these positions. A literature search of groundwater quality yielded no pertinent information for this area.

Surface Water Resources

The HSO is located on the watershed divide between the Lower Clackamas River fifth-field watershed (1709001122) and the Milk Creek fifth field watershed (1709000903), northeast of Colton, Oregon. In this topographic position, the orchard serves as the headwater area for a number of small streams within its boundaries. For ease of description, HSO is divided into two separate zones: one in Section 13 and one in Section 23, both of Township 4 South, Range 3 East. Streams in the Section 13 portion of HSO flow into Swagger Creek, a tributary to Clear Creek which flows into the Clackamas River. Streams in the Section 23 portion flow into Nate Creek, a tributary to Milk Creek which flows into the Molalla River (See Map 3 for stream locations).

Since HSO is located on a topographic divide, most of the streams that drain the area are relatively small and have headwater characteristics. These streams can be classified into three flow duration types; ephemeral, intermittent, and perennial flows. Ephemeral channels are streams which flow in direct response to winter storms and have channels that are always above the water table. Intermittent channels normally flow throughout the winter (November - April) and often are directly associated with the local water table during this time. Perennial streams flow year around and are connected to the local water table. For purposes of this analysis, streams in the orchard are also described by the persistence of the channel on the ground surface. Continuous channels flow on the surface of the ground, without interruption. Interrupted channels have variable expression on the ground surface with intervening reaches which may flow subsurface. These streamflow characteristics are pertinent in consideration of the susceptibility and risk of water pollution from aerial pesticide application. Table 4 contains hydrologic and riparian information pertaining to the surface waters that are immediately adjacent to, flowing through, or initiating from the HSO.

The historic extent of ephemeral channels in the orchard and their associated wet areas has been reduced through the installation of subsurface drainage (“tiling”). The purpose for tiling was to increase the area available for tree production.

Most wetlands on the orchard grounds are associated with the groundwater system adjacent to the stream channels, reservoir, and beaver ponds (See Map 3). There is one perennial reservoir in the west half of Section 13 which provides the orchard with water for irrigation and fire suppression. It has a surface area of approximately one acre and a storage water right of 2.5 acre feet. A perennial stream channel occurs at both the inlet and outlet of this reservoir.

A USGS streamflow gauge on Silver Creek (approximately 25 miles south of HSO) provides an indication of the relative timing and amount of streamflow of a similar watershed in terms of size, precipitation, land use, and vegetation. Table 3 illustrates the statistical summaries of fourteen years of record (adapted from USGS 1990). These values reflect the rainfall precipitation patterns. The only historical streamflow records (OWRD 1936 & 1937) from the Clear Creek and Nate Creek gauges indicate a similar pattern, with storm flow reductions after May.

Table 3 Statistical Summaries of Precipitation at Estacada and Runoff Pattern from Silver Creek

Month	Mean Monthly Precipitation	Number of Days with Measurable Precipitation	Percent Annual Runoff	Runoff per Square Mile (cfs/sq. mile)*
October	4.5	10	1.9	0.96
November	8.44	15	10.8	5.5
December	8.6	17	20.3	10
January	8.5	17	21.5	10.6
February	6.4	12	12.5	6.77
March	6.3	14	13.2	6.53
April	4.8	11	8.9	4.55
May	3.7	9	5.5	2.74
June	2.3	6	2.5	1.29
July	1.0	2	1.0	0.48
August	1.5	3	0.7	0.32
September	2.6	6	1.2	0.60

* derived from mean monthly flows; cfs = cubic feet per second

Table 4 Surface Water Information - Horning Seed Orchard

Stream # (From Maps 2 and 3)	Duration of Flow	Estimated Spring Discharge** ___________ Average Width of Channel	Flow Type	Minimum Width of Existing Vegetative Buffer	Type of Riparian Vegetation
3*, 11b	During and for Short Periods after Winter Storms	0.0 cfs ------------------ < 1 ft.	Interrupted Ephemeral	<50 ft.	Perennial Grasses and Orchard Trees
10b*	During and for Short Periods after Winter Storms	0.0 cfs ------------------ < 1 ft.	Interrupted Ephemeral	50 - 100 ft.	Perennial Grasses and Orchard Trees
4a*, 4c*, 8d	During and for Short Periods after Winter Storms	0.0 cfs ------------------ < 1 ft.	Continuous Ephemeral	<50 ft.	Perennial Grasses and Orchard Trees
6c*, 8b, 9e, 9g	During and for Short Periods after Winter Storms	0.0 cfs ----------------- < 1 ft.	Continuous Ephemeral	< 50ft.	Mature Conifer and Hardwood Trees; Well Developed Shrub Understory
9h	During and for Short Periods after Winter Storms	0.0 cfs ------------------ < 1 ft.	Continuous Ephemeral	50 - 100 ft.	Mature Conifer and Hardwood Trees; Well Developed Shrub Understory
11a, 10a*	Estimated to Flow from November Through April in Most Years	0.0-0.15 cfs ----------------- < 1 ft.;	Continuous Intermittent	< 50 ft.	Scattered Mature Hardwood Trees; Well Developed Shrub and Forb Understory
12a	Estimated to Flow from November Through April in Most Years	0.0-0.1 cfs ----------------- < 1 ft.;	Continuous Intermittent	< 50 ft.	Mature Conifer and Hardwood Trees; Well Developed Shrub Understory
2a*, 8a, 9f	Estimated to Flow from November Through April in Most Years	0.0-0.1 cfs ----------------- .5 - 1 ft.;	Continuous Intermittent	50 - 100 ft.	Mature Conifer and Hardwood Trees; Well Developed Shrub Understory
4d*, 6d*, 7a, 8c, 9b, 9d	Estimated to Flow from November Through April in Most Years	0.0-0.1cfs ----------------- .5 - 1 ft.	Continuous Intermittent	100^{+} ft.	Mature conifer and Hardwood Trees; Well Developed Shrub Understory

Stream # (From Maps 2 and 3)	Duration of Flow	Estimated Spring Discharge** ___________ Average Width of Channel	Flow Type	Minimum Width of Existing Vegetative Buffer	Type of Riparian Vegetation
2b*	Year-round Flow	.05 - .12 cfs ----------------- 1 - 2.5 ft.	Continuous Perennial	<50 ft.	Mature Conifer and Hardwood Trees; Well Developed Shrub Understory
1, 5a*, 7b, 9c	Year-round Flow	.1 - .5 cfs ------------------ 1 - 2.5 ft.	Continuous Perennial	100^{+} ft.	Mature Conifer and Hardwood Trees; Well Developed Shrub Understory
9a	Year-round Flow	.8 - 1.7 cfs ------------------ 4 - 6 ft.	Continuous Perennial	100^{+} ft.	Mature Conifer and Hardwood Trees; Well Developed Shrub Understory
6a* & 6b*	Year-round Flow	2.5 - 3.1cfs ------------------ 4 - 10 ft.	Continuous Perennial	100^{+} ft.	Mature Conifer and Hardwood Trees; Well Developed Shrub Understory
4b*	Wetland Has Year-round Saturation and Channel Flow During Winter Periods	0 cfs ------------------ < 1 ft.	Perennial	< 50 ft	Wetland Vegetation

* Channels downstream of proposed action
** Estimated flows during the Spring application period; cfs = cubic feet per second

The Oregon Department of Environmental Quality's 319 report (ODEQ,1988) describes the water quality conditions in the larger channels downstream from the HSO. The report identifies Milk Creek with moderate WQ problems (by observation) up to the vicinity of Union Mills (approximately River Mile 10). This is approximately nine miles below the orchard property. Further downstream, the Molalla River is reported to have severe water quality problems (by observation). Clear Creek has moderate water quality conditions at its confluence with Swagger Creek, approximately one mile below the orchard property. These reported conditions are summarized in Table 5.

Table 5. Water Quality Conditions - Homing Seed Orchard

319 Listing	Parameter	Impacted Beneficial Use	Suspected Cause(s)
Clear Creek, Reach 52	No Parameter Recorded	Cold Water Fish	Erosion, Debris
Milk Creek, Reach 56	No Parameter Recorded	Cold Water Fish	Industrial Runoff, Storage, and Transportation Leaks and Spills
Molalla River, Reach 54	Turbidity (S2) Sediment (M2) Low Do (M1) Low Flow (M1)	Irrigation Cold Water Fish Aesthetics	Landslides, Roads, Withdrawals, and Dredging

The Oregon Department of Environmental Quality's 303(d) list (ODEQ 1998) indicates those bodies of water which do not currently meet all applicable water quality standards necessary to protect beneficial uses. The 1998 list includes the Molalla River at the confluence with Milk Creek as water quality limited for bacteria, flow modification, and temperature. These listed segments are located approximately 19 miles below the orchard boundary in Section 23 T.4S., R.3 E. The list also includes the Clackamas River at the confluence with Clear Creek as water quality limited for temperature. These listed segments are located approximately 17 miles below the orchard boundary in Section 13, T.4S., R.3 E.

Existing beneficial uses derived from water rights records (OWRD 1999b) in and downstream of HSO are provided in Tables 6 & 7. Additional existing and potential beneficial uses are listed in the Oregon Administrative Rules (chapter 340) for both the Molalla and Clackamas river basins, and include the following: industrial and domestic water supplies; anadromous fish passage; aquatic life; wildlife and hunting, fishing, boating; water contact recreation; aesthetic quality; and hydro power. The state water quality parameter most likely to be affected by introduction of pesticides to water would be toxic concentrations. The most likely beneficial uses affected would be resident fish, aquatic life, and drinking water. The state water quality standards applicable to the orchard area are as follows:

> "Toxic substances shall not be introduced above natural background levels in the waters of the state in amounts, concentrations, or combinations which may be harmful, may chemically change to harmful forms in the environment, or accumulate in the sediments or bioaccumulate in aquatic life or wildlife to levels that adversely affect public safety, or welfare, aquatic life, wildlife, or other designated beneficial uses." [(OAR 340-41-445(2)(p)(A)]
>
> "Levels of toxic substances shall not exceed the criteria established by the EPA and published in the *Quality Criteria for Water* (1986), unless

otherwise noted." [OAR 340-41-445(2)(p)(B)]

"Where no published EPA criteria exist for a toxic substance, public health advisories and other published scientific literature may be considered and used, if appropriate, to set guidance values." [OAR 340-41-445(2)(p)(C)]

Table 6 represents the beneficial uses of record for streams draining from the Horning Seed Orchard in Section 13, T4S, R3E (Lower Clackamas Watershed).

Table 6 Beneficial Uses - Horning Seed Orchard (T4S, R3E, Section 13)

Beneficial Use*	Data Source	Waterbody	Distance from Orchard
Municipal Use: Oregon City / City of Clackamas	OWRD-WRIS	Clackamas River	Approx. 27 Miles
Resident Salmonids; Cutthroat Trout *** Warm Water Species ***	BLM	Unnamed Tributary to Swagger Creek	In Perennial Stream #6b, Located on the Orchard Property
Winter Steelhead and Coho Rearing and Spawning	ODFW	Clear Creek	Approx. 1 Mile
Fish Culture	OWRD-WRIS	Edna's Reservoir, Located in Swagger Creek	Approx. 2,500 Feet.
Irrigation	OWRD-WRIS	Unnamed Stream/ Reservoir Tributary to Swagger Creek	< 0.5 Mile
Livestock and Recreation	OWRD-WRIS	Unnamed Reservoir in Swagger Creek	Approx. 2,500 Feet** Certificate #70200
Irrigation / Domestic	OWRD-WRIS	Swagger Creek	Approx. 1.5 Miles** Certificate #16759

* These beneficial uses represent the first to be encountered downstream of the orchard in each of their categories. A full listing of non-canceled water rights of record (ORD-WRIS) is available at the Salem District Office.
** Not on OWRD map
*** Presence field verified by BLM 6/99

Data Sources: OWRD - WRIS = Oregon Water Resource Department -Water Rights Information System
ODFW = Oregon Department of Fish and Wildlife

Table 7 represents the beneficial uses of record for streams draining from the Horning Seed Orchard in Section 23, T4S, R3E (Milk Creek Watershed).

Table 7 Beneficial Uses - Horning Seed Orchard (T4S, R3E Section 23)

Beneficial Use*	Data Source	Stream	Distance from Orchard
Municipal Use: City of Canby	OWRD-WRIS	Molalla River	Approx. 25 Miles
Resident Salmonids; Cutthroat Trout **	BLM	Unnamed Tributary to Nate Creek	In Perennial Stream #9a, Located on the Orchard
Winter Steelhead Rearing and Spawning	ODFW (Suspected)	Milk Creek	Approx. 1 Mile
Irrigation	OWRD-WRIS	Unnamed Tributary to Nate Creek	0.25 Mile
Fish Culture	OWRD-WRIS	Reservoir Diversion from Nate Creek	3.5 Miles

* These beneficial uses represent the first to be encountered downstream of the orchard in each of their categories. A full listing of non-canceled water rights of record (ORD-WRIS) is available at the Salem District Office.
** Presence field verified by BLM 6/99

Data Sources: OWRD - WRIS = Oregon Water Resource Department -Water Rights Information System
ODFW = Oregon Department of Fish and Wildlife

Irrigation represents the majority of the recorded beneficial uses in the water rights records for the Milk Creek and Lower Clackamas Watersheds.

Fisheries

The Horning Seed Orchard (HSO) is located on the watershed divide between the Clackamas River and Molalla River subbasins, within the Willamette River basin. In this topographic position, the orchard serves as the headwater area for a number of small streams within its boundaries. For ease of description, HSO is divided into two separate areas: Section 13 and Section 23. Streams in the Section 13 portion of HSO flow into Swagger Creek, a tributary to Clear Creek, which flows into the Clackamas River. Streams in the Section 23 portion of HSO flow into Nate Creek, a tributary to Milk Creek, which flows into the Molalla River (See Maps 5 and 6 for stream locations).

Fish species which may be present in the Clear Creek drainage (Clackamas basin) include: fall chinook salmon (*Oncorhynchus tshawytscha*), coho salmon (*O. kisutch*), winter steelhead (*O. mykiss*), cutthroat trout (*O. clarki*), reticulate sculpin (*Cottus perplexus*), largemouth bass (*Micropterus salmoides*), western brook lamprey (*Lampetra richardsoni*) and Pacific lamprey (*L. tridentata*). Various other non-game species are present in the Clackamas River basin, but their distributions in Clear Creek are not well known according to the Oregon Department of Fish and Wildlife (ODFW 1992a). Fall chinook salmon are present in only the lower portions of Clear Creek, about 12 miles downstream from Swagger Creek. Coho salmon and winter steelhead are found in Clear Creek about one mile downstream from the HSO (Streamnet On-line query 5/26/99 and 7/07/99). It is not known if coho or steelhead use Swagger Creek; however, a high gradient stream reach about one-half mile downstream of the HSO likely is a barrier to upstream movements. The coho salmon in Clear Creek are thought to be of hatchery origin. Cutthroat trout are found in streams throughout most of the Clear Creek drainage.

The seed orchard (Section 13) includes several small headwater creeks which flow into Swagger Creek. There is one larger perennial stream (stream 6a) which bisects Section 13 and several smaller perennial streams (streams 1, 2b 5a and 7a). Cutthroat trout are known to reside in streams 5a and 6a. Cutthroat trout have been collected below a barrier dam at the orchard's irrigation pond on stream 6a. No cutthroat trout were collected upstream of the dam, but it is likely that cutthroat trout are found in the irrigation pond and further upstream. Cutthroat trout are also found in most of the perennial portion of stream 5a. There is no habitat for listed anadromous fish on the seed orchard property in Section 13. Lower Columbia steelhead trout utilize Clear Creek in the vicinity of its confluence with Swagger Creek approximately one mile downstream of the seed orchard. Upstream migration of steelhead in Clear Creek is blocked by barrier falls on both forks just above the confluence of Clear Creek and N.F. Clear Creek, approximately two miles above the Swagger Creek confluence. It is not known if steelhead use Swagger Creek, but the very lower portion of Swagger Creek appears to be accessible (Swagger Creek is not identified as steelhead habitat according to Streamnet information). There appears to be a topographic barrier to upstream fish movement on Swagger Creek about 0.5 miles above the confluence with Clear Creek. The barrier occurs on private land and has not been inspected, however based on a USGS topographic map the elevation change is approximately 300 feet within less than 1/4 mile. The nearest known habitat for Lower Columbia chinook salmon is approximately 12 miles downstream of the seed orchard in the lower portion of Clear Creek. The nearest known habitat for Upper Willamette chinook salmon is 16 miles downstream of the seed orchard in the mainstem Clackamas River. There is virtually no information available on the status of any anadromous runs in Clear Creek.

Several small largemouth bass were collected above the irrigation pond. It is suspected, the largemouth bass came from an upstream millpond on private land. The water temperature of the stream above the irrigation pond on June 24, 1999, was 17 °C (62.3 °F). This was very warm considering the cool spring weather. The upstream millpond may be the source of the warm water. Given the warm water temperature in June, the temperature in late summer in this stream segment is probably too warm for trout. However, trout exist upstream of the millpond.

Fish species which may be present in the Milk Creek drainage (Molalla subbasin) include fall chinook salmon, coho salmon, winter steelhead, cutthroat trout, sculpins (*Cottus* spp.), and western brook lamprey. Various other non-game species are present in the Molalla River basin, however, their distributions in Milk Creek are not well known. Fall chinook salmon and coho salmon are not native to the Willamette River above Willamette Falls but were introduced into many Willamette Valley streams during the last century. Fall chinook salmon are found in the lower portion of Milk Creek, about 12 miles downstream of the HSO. Coho salmon were observed in Nate Creek, about two miles downstream of the HSO, in 1983 (Hunt, pers. com.) Hatchery releases of coho salmon into the upper Willamette River basin were discontinued in 1988, and viable coho runs are not thought to be occurring still. Winter steelhead are native to Milk Creek. Steelhead spawn in Milk Creek and its tributaries, Jackson and Canyon creeks, but there is no documented use by steelhead in Nate Creek. Steelhead habitat in Milk Creek is about one mile downstream from the HSO (ODFW 1992b, Streamnet On-line query 5/26/99 and 7/07/99).

The seed orchard in Section 23 is bisected by the headwater segment (stream 9a) of Nate Creek, the only perennial stream in this portion of the orchard. Nate Creek, a headwater tributary of Milk Creek, is about five miles long and is not used by steelhead. A survey of stream 9a, conducted in June 1999, found cutthroat trout and sculpin throughout the entire length of the stream within the HSO, however the intermittent tributaries do not support fish. The few trout collected were small, 3-5 inches, and widely scattered along the stream. These fish were likely age 1+ and age 2+. Some cutthroat trout are capable of spawning at age 2+ (ODFW 1992b). In the southeastern portion of Sec tion 23 there are two ephemeral/intermittent streams (streams 8 and 10) which drain into Milk Creek approximately one mile south of the orchard. Steelhead may use Milk Creek in the vicinity of the confluences with these two small streams. The nearest known habitat for Upper Willamette chinook salmon is 16 miles downstream from the orchard. The lower seven miles of Milk Creek maybe used by chinook for juvenile rearing; no spawning occurs in Milk Creek. There is virtually no information available on the status of any anadromous runs in Milk Creek.

Crayfish were collected in the perennial reachess of streams 6b and 9a within the HSO.

Nearly all nearby streams are buffered with natural riparian vegetation, including a relatively dense overstory of conifer and hardwoods (Table 8).

Table 8 Approximate Distance from Orchard Units to Surface Water

Orchard Unit	Orchard Section	Drainage	Closest Tributary Channel	Approx. Distance to Surface Water (intermittent flow) in feet
P11	Section 13	Clear Creek	trib 5a	160
P12	Section 13	Clear Creek	trib 2b	45-50
P13	Section 13	Clear Creek	trib 5a	160 - 280
B14	Section 13	Clear Creek	trib 2a	0
B34	Section 13	Clear Creek	trib 6a	201
P30, 33	Section 23	Milk Creek	trib 10a trib 8a	830 1700

Special Status Fish Species

Table 9 depicts the fish species within the Clackamas and Willamette River systems that warrant special status.

Table 9   Special Status Fish Species On or Near the Horning Seed Orchard

Species	Status	Estimated Distance to Nearest Habitat from HSO
Clackamas River Drainage		
Lower Columbia River Steelhead Trout	Federal Threatened	1 mile
Lower Columbia Chinook Salmon	Federal Threatened	12 miles
Upper Willamette Chinook Salmon	Federal Threatened	16 miles
SW Washington/ Columbia River Cutthroat Trout	Federal Proposed Threatened	1 mile (if only migratory forms are listed) On site (if resident forms above barriers are listed)
Sw Washington/Lower Columbia River Coho Salmon	Federal Candidate	16 miles
Pacific Lamprey	Bureau Tracking	unknown
Molalla River Drainage		
Upper Willamette Steelhead Trout	Federal Threatened	1 mile
Upper Willamette Chinook Salmon	Federal Threatened	15 miles
Pacific Lamprey	Bureau Tracking	unknown

Within the Clackamas drainage, Lower Columbia River steelhead, Lower Columbia River chinook salmon and Upper Willamette River chinook salmon have all been listed as “threatened” under the Endangered Species Act (ESA). Lower Columbia River/SW Washington coho salmon are a candidate species for listing under the ESA and have been listed as “endangered” by the State of Oregon. The only listed species which occurs near the vicinity of the HSO is the Lower Columbia River steelhead trout. These fish are found in Clear Creek, approximately 1 mile downstream from the orchard. Swagger Creek, a tributary to Clear Creek, is not considered to provide habitat for steelhead trout.

The cutthroat trout found within Section 13 of the seed orchard will likely be included in the Southwestern Washington/ Columbia River cutthroat trout “evolutionarily significant unit" (ESU). The cutthroat of this area has been proposed for listing as "threatened" by the U. S. Fish and Wildlife Service.

Within the upper Willamette River drainage, above Willamette Falls, there are two fish species which have been listed as "threatened" under the ESA: Upper Willamette chinook salmon and Upper Willamette River steelhead trout. Only the Upper Willamette River steelhead trout are found near the HSO. Steelhead are found in Milk Creek, but are not known to utilize any of the Milk Creek tributary streams which drain from the orchard.

Pacific lamprey, a BLM sensitive species, are found in the Willamette River basin. There is no data available on the distribution of lamprey in streams in the vicinity of the orchard.

Vegetation and Special Status Plants

The orchards are planted in Douglas-fir (*Psuedotsuga menziesii*), western hemlock (*Tsuga heterophylla*), western red cedar (*Thuja plicata*), western white pine (*Pinus monticola*), sugar pine (*P. lambertiana*), and noble fir (*Abies procera*). Giant sequoia (*Sequoia gigantea*) are planted along orchard perimeters or fence lines as wind/pollen barriers. Botany surveys were conducted in areas which were considered to be potential habitat for special status species. These areas included the orchard perimeters, fence lines, and riparian zones. **No special status species were found in the area surveyed.**

The plant communities found in the riparian zones of both Section 23 and Section 13 are dominated by native species and are also very similar. The overstories are dominated by Douglas-fir (*Pseudotsuga menziesii*) and western redcedar (*Thuja plicata*), and the understories include western hemlock (*Tsuga heterophylla*), red alder (*Alnus rubra*), bigleaf maple (*Acer macrophyllum*), California hazel (*Corylus cornuta*), cascara (*Rhamnus purshiana*), vine maple (*Acer circinatum*), black cottonwood (*Populus tricocarpa*), and Pacific dogwood (*Cornus nuttalli*). The shrub layer in these riparian zones include salal (*Gaultheria shallon*), thimbleberry (*Rubus parviflorus*), and red huckleberry (*Vaccinium parvifolium*) with swordfern (*Polystichum munitum*). Salmonberry (*Rubus spectabalis*), lady fern (*Athyrium filix-femina*), and deer fern (*Blechnum spicant*) which are additional species present in areas of higher moisture. A reservoir in the northwest quarter of Section 13 is surrounded by riparian vegetation including pondweeds (*Potamogeton* spp.), sedges (*Carex* spp.), and rushes (*Juncus* spp.).

Invasive exotic species such as Himalayan blackberry (*Rubus discolor*), evergreen blackberry (*R. laciniata*), and butter-and-eggs (*Linaria vulgaris*) were found along the fence lines and along orchard perimeters. In addition, so were the following well established, common noxious weed species: Scotch broom (*Cytisus scoparius*), tansy ragwort (*Senecio jacobaea*), Canadian thistle (*Cirsium arvense*), bull thistle (*C. vulgare*) and Klamath weed (*Hypericum perforatum*).

Wildlife

Limited wildlife inventories have been conducted in or adjacent to the Horning Seed Orchard area to determine the wildlife species that are present. Therefore, species that are thought to occur here, is based on the type and amount of habitat available in or adjacent to the seed orchard associated with the Willamette Valley Physiographic Province. Some species, in particular large animals such as black bear, deer, elk, and cougar, have been limited by the enclosure fence around the plantations within the seed orchard. Other species like bats, swallows, bluebirds, and wrens have been encouraged by installing nesting or roosting boxes.

Habitats

The habitat a particular wildlife species uses is determined by the kind, structure, and mix of plant species within a vegetative community, and for some species, proximity to water and riparian conditions (Brown et al. 1985). Habitat is further defined by the size and interspersion of plant communities within and adjacent to an area. At the Horning Seed Orchard, most of the vegetative communities, or habitats, are relatively simple in composition and structure due to their managed history. Natural ecological functions or processes are also simplified. Adjacent farm and wooded lands are also similar to the seed orchard in this regard.

Horning Seed Orchard is 800 acres in size (See Map 7 Aerial Photo). Within this area, eight different habitats occur, excluding the seed orchard facilities and transportation corridors: young (1-30 years old) conifer stands (managed); mid-age (40-80 yrs) conifer stands (unmanaged); riparian corridors; hardwoods; shrub patches; wetlands; upland meadows (managed); and aquatic habitats (ponds, streams).

These habitats are described below in terms of their associated function and value to wildlife:

Young Conifer Stands

Approximately 300 acres of managed, young (1-30 years old), conifer stands are scattered in small, even-aged patches throughout the seed orchard. The vegetation is very simple because these patches have been tilled or cleared of native vegetation and replanted to open-space selected trees. Groundcover is primarily grass with some open areas of forbs, with no coarse woody debris present. The understory is managed by mowing, tilling, grazing, and weeding. Lack of structural diversity limits the number of wildlife species using it. Most of the species — robins, quail, black-capped chickadees, garter snakes, and starlings — are also common in the surrounding area. Some ground-nesting species use this area in the spring and summer. The short groundcover provides habitat for small mammals such as voles, gophers, and moles, which serve as prey for owls and hawks in the vicinity.

Mid-Age Conifer Stands

Approximately 180 acres of mid-age conifer stands are scattered along the riparian habitat. These have been salvage logged in the past. Because these stands are directly adjacent to the riparian areas, they add to the riparian diversity. As a result of previous management, they lack large old-growth trees, large snags, and coarse woody debris. The overstory is a relatively closed canopy, and there is a moderately dense understory of shrubs. Wildlife using this area include bird species such as pileated woodpeckers, red-tailed hawks, great horned owls, flycatchers, kinglets, brown creepers, and varied thrushes. Most of these species are common in nearby lands. This habitat type is not old enough, diverse enough, or large enough in area to provide habitat for northern spotted owls. The unfenced areas provide some limited thermal cover for deer.

Riparian Corridors
Riparian corridors are limited in distribution to six linear, narrow bands of approximately 20 acres near perennial and intermittent waterways. Dominant species include red alder and Douglas-fir, with some maple and a understory of salmonberry, huckleberry, and elderberry. Western red cedar is almost all gone from this habitat type because it was cut for fence posts and cedar shakes in the past. This area also lacks large old-growth trees and large snags. A moderate amount of coarse woody debris in decay class 4 and 5 remains from historic logging that took place here.

Because of the moderate diversity of vertical structure and plant species composition, this habitat supports more wildlife than any place in the Horning Seed Orchard. However, the value of this habitat is somewhat limited by its fragmented nature, small area, and lack of large trees, snags and coarse woody debris. Thus, it is most suited for species which are tolerant of disturbance and that prefer edge conditions. This habitat is especially important since it provides nesting sites adjacent to open foraging areas as well as corridors to other adjacent habitats. Species that use this habitat include frogs, raccoons, grosbeaks, song sparrows, cedar waxwings, spotted towhees, and neotropical bird migrants during the nesting season. The unfenced areas provide some limited thermal cover for deer.

Hardwoods
There are just a few patches of pure hardwood in the orchard. They occur adjacent to the riparian habitat or within mid-age conifer stands. All together this habitat probably makes up less than five acres. Wildlife associated with this habitat is expected to be similar to those using the riparian corridors.

Shrub Patches
Two shrub patches, totaling approximately 60 acres, occur in Section 13. Both patches consist of areas that have been cleared for plantations but never used and/or allowed to grow up into a dense cover of hazel, cascara, red alder, blackberry, and Scotch broom, with some small scattered Douglas-firs. These patches provide high quality foraging and hiding areas for an assortment of animals, from hummingbirds and song birds to rabbits, coyotes, and deer. This habitat could be converted to young conifer stands (plantations) as needed at any time.

Wetlands

Approximately three acres of wetlands at the heads of some of the small streams and around the two ponds occur within the area. They are very important to certain species such as frogs, salamanders, beavers, raccoons, mallard ducks, and an assortment of small mammals. These wetlands are inside forest stands, and their small size and the surrounding vegetation limits their use by many wetland species.

Upland Meadows

All of the meadows in Horning Seed Orchard are manmade, created by clearing the natural coniferous forest and then replanting it with young conifer stock and/or allowing it to be invaded by grass. Within the orchard, there are currently about 160 acres of upland meadow, mostly in the north half of Section 23. These meadows are periodically mown or grazed to reduce ground cover. Some of the meadows have a few scattered Douglas fir in them, but they serve wildlife primarily as early successional habitat. This ultimately limits wildlife use to small mammals that forage in the low ground cover, some ground nesting birds, and avian predators such as kestrels, great horned owls, and red-tailed hawks that prey on the small mammals. These areas are transitional, being replanted to young trees as needed.

Aquatic Habitat

One small pond (about one acre), about three miles of active first and second-order streams, and several beaver ponds occur within the area. Few large snags or coarse woody debris are present near these aquatic habitats. These limited aquatic habitats provide water to the majority of terrestrial wildlife in the area. (Associated aquatic species are described in other parts of this document.)

Special Status Wildlife

The Endangered Species Act (ESA) of 1973, as amended, provides protection for threatened or endangered species and their habitat against any action that may jeopardize the continued existence of those species. **No Federally listed threatened or endangered wildlife, including the Northern spotted owl, occur in or near the Horning Seed Orchard.** The seed orchard is in the Willamette Valley Province, outside the normal range of the spotted owl. In 1992 and 1993, surveys for spotted owl were conducted at the seed orchard and there were no responses. The spotted owl is an interior older forest predator. Habitat within or adjacent to the seed orchard lacks large old trees, snags, and coarse woody debris indicative of older forest preferred by spotted owls. This area is not adjacent to suitable habitat and is not linked to any other habitat areas. Disturbance by workers and their equipment at the seed orchard and the activities of surrounding landowners also make it highly unlikely that spotted owls would be found within or adjacent to the orchard.

The Bureau of Land Management (BLM) maintains a list of species for which viability is a concern (Special Status Species List). Affected species from this list are discussed below.

Western Pond Turtle

It is unknown if Western pond turtles occur at Horning Seed Orchard. These turtles could occur in and around the ponds and wetlands in the seed orchard. The water temperature in the stream above the reservoir was 63 degrees F., during the early spring of 1999. It is warm enough to support turtles. They prefer habitat to be a combination of quiet and fairly clear water, with emergent rocks or logs which serve as basking areas, some aquatic vegetation, and nearby sunlit ground. Lack of basking areas, emergent vegetation, and siltation are limiting factors that may preclude turtles from using Horning Seed Orchard's aquatic and riparian habitats. They have been found to travel several hundred feet in short vegetation with loose warm soils to excavate a nest. Turtles could travel up or down the small streams in the area to get to other ponds.

Common Nighthawk

Nighthawks feed over a wide range of habitat types especially wet areas which produce a large insect population. They are ground nesters in open areas, occasionally on little used roads, clearcuts, and landings. Nighthawks are becoming increasingly rare in the Willamette Valley. Most of the roads and open areas in the seed orchard are subject to high levels of human disturbance, so nesting is unlikely.

Oregon Vesper Sparrow

This species was formerly common to locally abundant throughout the Willamette Valley, but has largely disappeared from much of its northwest Oregon range. Recent studies indicate that Christmas tree farms, especially those in which weeds and grass are not as frequently controlled, provide usable habitat structure and food for Vesper sparrows. Small trees or low shrubs for singing perches, some percentage of area in bare ground, grass and other weed seeds, and insects are all important habitat components for this species. Parts of Horning Seed Orchard would provide suitable breeding habitat for Vesper sparrows. Due to the similarity between songs of the Vesper sparrow and the abundant Song sparrow, Vesper sparrows might be easily overlooked during surveys.

Western Meadowlark
Meadowlarks inhabit open grasslands, pastureland, and open woodlands. They perch on short trees, shrubs, and fence posts. It is a ground nester in medium to high grass. Meadowlarks are becoming increasingly rare in the Willamette Valley during the nesting season, but can be seen in open pasture grassland in large flocks in the winter. The highly altered habitats of the Horning Seed Orchard makes breeding of this species here, unlikely.

Streaked Horned Lark
This subspecies inhabits open fields, particularly with bare ground or sparse vegetation. It nests and forages on the ground. It could use newly created plantations that have been tilled or mowed for the first few years and the adjacent edge habitat in older plantations. It may occur in meadow areas, particularly those that have been grazed or mowed. It is very rare in the Willamette Valley.

Survey and Manage Species
Certain species were identified in the Northwest Forest Plan and its associated decision documents and in the Salem Resource Management Plan, Record of Decision, as species requiring special attention regarding forest harvest activities. The Horning Seed Orchard is an administratively withdrawn parcel with a mandate different than the remainder of lands managed by Salem District-BLM, and will never be managed for late successional forest where “Survey and Manage” species are generally found. Therefore, these species were not considered in this environmental assessment.

Chapter 4 - Environmental Consequences

Resources Unaffected by the Proposed Action

Since the proposed action is not a ground disturbing activity and the chemical and its inert ingredients that may be used has no affect on plant species, there are not expected to be any impacts on plants or cultural resources. Requirements of “Environmental Justice” policy have been reviewed and the proposed action will have no impact on subject populations.

Overview of Esfenvalerate

Esfenvalerate is a synthetic pyrethroid insecticide similar in composition to the naturally occurring compound fenvalerate, also used as an insecticide. It is applied alone or in combination with a wide variety of other types of pesticides. Asana (a formulation of esfenvalerate) is registered as a moderately toxic pesticide for use for forestry, range, and right-of-way pest control. As a Type II pyrethroid, it affects the function of the nervous system by interfering with the operation of the sodium channel in the nerve members following ingestion. It is applied using ground and aerial applicating equipment.

Esfenvalerate has a half life of as little as 7.5 days in direct sunlight. Its half-life may be up to three months in soil. It binds to organic matter in the soil and has little mobility. Esfenvalerate is practically insoluble in water. The potential for leaching into groundwater is very low. Tests show that the half-life in water ranges from 10 to 220 days. When sprayed along the littoral area of a pond, it <u>could not</u> be detected in the water four days after spraying, but measurable amounts could be detected on plants and sediment.

Esfenvalerate in low levels does not cause mortality in birds or mammals, and shows only limited carcinogenic and tetragenic impacts. It is toxic to other insects, and can lead to loss of other insects including those that are beneficial. Esfenvalerate is highly toxic to fish and aquatic invertebrates. It may bioaccumulate in the tissues of fish and other aquatic organisms. With rainbow trout, the LC50 was 0.0003 mg/l.

<u>Potential for adverse health effects from inert ingredients contained in the formulated product::</u> Because of concern for human health and the environment, the U.S. Environmental Protection Agency (EPA) announced its policy on inerts of toxicological concern (Lists 1 and 2) in the Federal Register on April 22, 1987 (52 FR 13305). The intent of this policy is to encourage the use in pesticide products of the least toxic ingredients available. List 1 includes those chemicals with inert ingredients of toxicological concern. List 2 includes those chemicals with potentially toxic inerts or those which are of high priority for testing. No inerts cited on EPA List 1 are included in Asana XL®. The inert ingredients found in Asana XL® include xylene and ethylbenzene which are on EPA List 2. High doses of xylene have produced effects in the liver, kidney, lung, spleen, heart, and adrenals of laboratory animals. Rats and mice exposed to xylene during pregnancy showed embryo/fetotoxic effects. Ethylbenzene is

moderately toxic by ingestion and mildly toxic by inhalation and skin contact. It is irritating to the eyes, skin, and mucous membranes. In high concentrations, ethylbenzene may cause stupor and coma. Exposure to high doses of the inert ingredients may cause central nervous system depression. When used according to the manufacturer's directions, exposures to inert ingredients will be much less than the levels at which these health effects have been observed.

Effects on Human Health

Alternative 1 - No Action

Because esfenvalerate application would not occur under Alternative 1, there would be no risk to humans.

Alternative 1 - Proposed Action (Aerial Esfenvalerate Application)

Monitoring of aerial spray drift in previous projects at the seed orchard have shown that design features and application methods have achieved excellent results in containing spray to the application areas. Drift monitoring on "splash" cards around the spray sites indicate no drift outside of the spray units. Thus, analysis of human health effects was limited to exposure on site or from water going off site.

A complete Human Health Hazard Assessment, Human Health Exposure Assessment, and Human Health Risk Characterization was completed for the Oconto River Seed Orchard in 1997 (USDA Forest Service 1997b). These documents included discussions on: health protection measures; pesticide fate and transport; methodology; analysis of exposure and doses; affected populations, including the public and workers; and potential for exposure. The protection measures, method of application and the rates of application were the same as in the proposed action at Horning Seed Orchard. Results of GLEAMS modeling for the proposed action yielded exposure levels in ground water that are consistent with (or less than) evaluated in the Oconto Risk Assessment. Of particular importance, modeling showed that spray residue would not reach ground water and would thus have no effect on local domestic water wells. The interdisciplinary team for this environmental analysis reviewed the Oconto Risk Assessment and concluded that it can be tiered to in total for the esfenvalerate applications in the proposed action.

Conclusions in the Oconto FEIS were that exposures to esfenvalerate applied by aerial means were well below benchmark levels of concern. The only exposure above levels of concern was exposure to concentrated chemicals in a direct spill accident. This kind of exposure is highly unlikely and can be mitigated through normal safety and hazardous material procedures as outlined in the design features applicable to the proposed action.

On the basis of the Oconto Risk Assessment, considering the similarity of the proposed action with the action analyzed in the Oconto FEIS, and the consistent results obtained from modeling the proposed action, the interdisciplinary team concludes that the proposed action will not have any significant effects on human health.

Effects on Soils

Alternative 1 - No Action

Because esfenvalerate application would not occur under Alternative 1, there would be no risk of entry into soils.

Alternative 1 - Proposed Action (Aerial Esfenvalerate Application)

The issue of environmental quality relates directly to the soil resource. There may be a concern about the potential for chemical buildup in the soil. There is also a concern about long term soil productivity, both in terms of chemical pesticides and from soil loss due to erosion and compaction. The next two sections discuss the ways pest management could affect the soil resource.

Pesticide buildup and residues - There may be concern that chemical use in the same areas could lead to a buildup of residues in the soil. Table 10 shows the behavior of the proposed chemical in the soil. The half-life of a chemical pesticide is the number of days it would take for half of the residue to break down. In general, the chemicals proposed for use, break down fairly quickly and therefore do not accumulate in the soil.

Table 10 Breakdown Behavior of Esfenvalerate

Pesticide Type	Solubility in Water	Persistence in Soil	Leaching Potential	Volatility	Major Degradation Mechanism
Esfenvalerate	Low	Moderate	Negligible	Low	Biological and Chemical

Solubility:
High > 100 ppm; Moderate 1 to 100 ppm; Low < 1 ppm.

Persistence:
High = half life > 180 days; Moderate = half life of 30 - 180 days; Low = half life < 30 days.

Volatility:
High = vapor pressure > 1.00 mm of mercury; Moderate = vapor pressure - 1.0 to .0001 mm of mercury; Low = vapor pressure < .0001 mm of mercury.

Chemical pesticides break down in the soil and water in two main ways: chemically and biologically. Chemical breakdown in water and soil depends on several factors, including pH, temperature, soil minerals, light, moisture, and organic matter content. When chemicals are broken down by the soil itself the process is usually chemical. When the breakdown is done by organisms in the soil, there are several ways the breakdown can occur.

In microorganisms, e.g., bacteria, fungi, and some algae, hydrolysis appears to be the major process through which pesticide compounds are broken down to nontoxic products. This action is governed by various enzymes contained within the organisms. Enzymes allow the microorganisms to metabolize the pesticides. These organisms take the chemicals needed for life, such as phosphorus and carbon, and leave the other, usually harmless, chemicals.

Chemical degradation of pesticides in soil and water can occur when the pesticide composition is unstable at higher pH and temperatures. There soils are alkaline and contain low organic matter content, hydrolysis may be the primary reaction. Soil composition also affects the ability of a pesticide to be absorbed into the soil particles or adsorbed to the outside of the soil particle. A high organic matter content lessens the amount of pesticide broken down by hydrolysis.

Pesticides not broken down can leach out of the soil. The leaching ability of a pesticide is affected by the moisture content, permeability, and absorption or adsorption power of the soil.

Based upon the breakdown behavior of esfenvalerate, the design features incorporated into the proposed action, and the soil types and processes in the orchard, there are not expected to be any impacts on orchard soils as a result of the proposed action.

Effects on Water

Water Quality issues include the possibility of esfenvalerate entering the streams in and around the seed orchard and the possibility of esfenvalerate reaching the groundwater.

Alternative 1 - No Action

Because esfenvalerate application would not occur under alternative 1, there would be no risk of entry into surface or groundwater.

Alternative 2 - Proposed Action (Aerial Esfenvalerate Application)

Surface Water
There are 3 primary scenarios of how esfenvalerate could reach stream channels, reservoirs, and wetlands due to the proposed action: through runoff from the applied fields, drift from the aerial spray, and potential spills in and near stream channels. Spray drift to any surface water is not expected to occur with implementation of design features. The primary Best Management Practices to avoid drift in the project include: application only during calm conditions and the design of substantial spray buffers (most greater than 200 feet) around the stream channels, reservoirs, and wetlands. Spills near any water will be avoided through siting the mixing and loading zones in the compound area (greater than 1000' from surface water). Transit of the helicopter between units will not occur over any surface water. These Best Management Practices should avoid the scenario of drift and spill delivery of esfenvalerate to surface waters. For a full list of design features refer to Chapter 2.

Determining the concentrations of esfenvalerate which could enter the streams through runoff and sedimentation from the application orchard units was the primary focus for the water impact analysis. This was done through modeling the fate of esfenvalerate using the GLEAMS v 3.0.1 model (Groundwater Loading Effects of Agricultural Management Systems). The GLEAMS model, developed by the USDA Agricultural Research Service, is a computerized mathematical model developed for field-sized areas to evaluate the movement and degradation of chemicals within the plant root zone under various crop management systems. The model has been tested and validated using a variety of data on pesticide movement and has been used extensively in prior risk analysis for insecticide use in seed orchards (USDA Forest Service 1995, 1997a, 1997b).

GLEAMS has four main components: hydrology, erosion, nutrients, and pesticides (the nutrients component is for fertilizer applications only). The hydrology component subdivides the soil within the rooting zone into as many as 12 computational layers. Soils data describing porosity, water retention characteristics, and organic matter content for the site-specific soil layers are collected for model initialization. During simulation, GLEAMS computes a continuous accounting of the water balance for each layer, including percolation, evaporation, and transpiration. The erosion component accounts not only for the basic soil particle size categories (sand, silt, and clay), but also for small and large aggregates of soil particles. The program accounts for the unequal distribution of organic matter between soil fractions. The pesticide component can represent chemical deposition directly on the soil, the interception of chemicals by foliage, and subsequent washoff. Degradation rates are allowed to differ between plant surfaces and soil, and between soil horizons. Input data required by the GLEAMS model consist of: rainfall data, temperature data, hydrology parameters, erosion parameters, and chemical parameters. Output from the GLEAMS model includes accounting of concentrations by soil layer for each chemical, and the movement of pesticide residues in percolating soil water, surface runoff water, and those residues adsorbed to eroding soil particles on a daily basis.

The runoff and sediment concentrations predicted by the GLEAMS model are assumed to be the "edge of field" concentrations. The model is not able to predict the fate of chemical runoff and sediment concentrations moving through riparian buffers and wetland sites. All of the streams at the seed orchard have an existing densely vegetated riparian zone which range in width from around 40 feet to several hundred feet. These areas contain un-compacted soils with thick surface litter and high organic matter content. It is very likely that most of the esfenvalerate that the model predicts could runoff from the orchard units, would be captured in the riparian buffers through adsorption to soil and organics. Many of the intermittent and perennial streams have a wetland system along the channel edge. These too would offer adsorption sites for runoff events. Since the fate of the chemical within these buffers cannot be modeled, a conservative approach was taken. It was assumed that the concentration of esfenvalerate leaving the fields was the amount entering the streams. For this reason, the concentrations of esfenvalerate predicted in the modeling are likely to be significantly higher than any actual stream concentrations (if any) that may result from implementation of the proposed action.

Aerial esfenvalerate treatment was modeled for one application in 2001 to occur in mid-April. A five year continuous climate record was used to run the model. This record was selected from the Estacada weather station and represents a period of average precipitation. This was applied to the seven proposed orchard spray units. The units modeled and the associated streams are identified on Maps 2 and 3 and in Table 11. A relative risk for direct introduction of runoff and sediment to stream channels is also provided since the model does not account for concentration reduction in buffers. High risk would be assigned to any units with visible stream channels in the unit. Moderate risk would be associated with orchard units with surface topography that provides hydrologic connection to downslope channels during intense storm events. Low risk would be those orchard units which have no visible surface connection to the downslope channel system. Any potential runoff in these units would be expected to go subsurface and have high adsorption potential in the soil.

Table 11 Proposed Units, Potentially Affected Streams, and Relative Transport Risk

Orchard Unit	Orchard Section	Unit Acres	Associated Stream ID	Direct Runoff Risk of Pesticide
P11	Section 13	2.27	3 , 5a *	LOW
P12	Section 13	1.8	2b	MOD
P13	Section 13	2.46	3 , 5a *	LOW
B14	Section 13	9.1	2a,	MOD
B14	Section 13	.9	5a	LOW
B34	Section 13	5.5	6c	LOW
P30, 33	Section 23	8.6	10b	LOW

* at downstream confluence

To determine the on-site impacts of runoff and sediment transport, the esfenvalerate concentrations were modeled for three stream sites (2b, 5a , downstream confluence of 5a , and 6b) in Section 13, which are known to have cutthroat trout and account for all the potential runoff from the proposed action. Results are provided in Section 23 for delivery to Milk Creek due to the close proximity to the orchard boundary (see cumulative effects discussion). Table 12 contains the modeling results in relation to the fields applied. Concentrations are based on the mass of pesticide predicted to runoff the fields and then diluted by the streamflow of the associated stream. Two concentrations per site were modeled: 1) during peak winter flows when concentrations of esfenvalerate have the greatest potential to runoff and 2) during maximum spring-time flows when cutthroat embryos maybe present and runoff can occur. The number of modeled runoff events which exceeded the potential to affect embryos (.00009 mg / l) compared to the total number of spring runoff events is provided. Discussion on the risks of modeled concentrations to Aquatic Species are presented in the .

Table 12 Modeled Concentrations of Esfenvalerate (Asana XL) for Tributaries to Swagger Creek

Waterbody	Orchard Unit Contributing Concentration	Number of Exceed Events / Total Runoff Events	Modeled 24 Hour Maximum Stream Concentration (mg/l)*	Flow Period
Stream # 2b	B-14 portion, P-12 portion	2 / 9	0.000109 0.000212	winter flow spring flow
Stream # 5a	P-14 portion	0 / 9	0.00000649 0.0000126	winter flow spring flow
Downstream confluence # 5a	P-11, P-13, P-12, B14 portion	0 / 9	.0000306 .0000875	winter flow spring flow
Stream # 6b	B - 34	0 / 9	0.0000028 0.00000544	winter flow spring flow

Surface Water Discussion: Modeled concentrations for all tributaries to Swagger Creek are very low with the exception of stream 2b. Higher modeled concentrations can be expected in this stream as the dilution factors are low due to the small watershed and lower flows. There are no fish in this stream. For potential downstream impacts to fish refer to the . These modeled values are very conservative because capture of esfenvalerate cannot be quantified for the buffers surrounding these streams and adsorption of residue is very likely in the riparian areas. All of these channels (except 2a and b) have a low potential to deliver surface runoff and sediment directly to a channel. Stream 2b and the associated headwater channel 2a are recognized as having higher risk due to the proximity to units B14 and P12. Erosion off the unit should be non-existent through implementation of Best Management Practices such as significant no spray riparian buffers (200 feet +), silt fences, and 100% sod ground cover. This will keep any soil and organic particles with adsorbed esfenvalerate from leaving these units. In terms of surface runoff, Best Management Practices that promote the infiltration of surface water in the units will be implemented. These include avoiding any application during saturated conditions, aerating all units before application, and providing non-compacted buffers to promote entry of any runoff into untreated litter and soil material. Other than fish, irrigation is the only potentially affected downstream beneficial use. Concentration of pesticide in the stream water would only occur during high flow events when surface runoff from fields was likely. Since irrigation usually occurs during the months of traditional low flow (July, August, and September) there should be no risk.

Groundwater
Output from the GLEAMS model includes accounting for concentrations of esfenvalerate which would percolate below the root zone. For this analysis, the root zone was considered as the soil surface down to a depth of 24 inches. It is assumed that any pesticide migrating to the depth of 24 inches could enter the local groundwater table during the winter period. The results from modeling all the orchard units in the proposed action indicate there was no movement of esfenvalerate below the depth of 24 inches. This is largely due to the very high adsorption rates especially in soils with high clay content.

Cummulative Effects Asessment: Water Gleams modeling was conducted on the proposed action for sub-watersheds within the Milk Creek and Clear Creek Watersheds. The cummulative effects to sub-watersheds were selected to address the downstream listed fish: (Lower Columbia steelhead trout (*Oncorhynchus mykiss*) in the Clear Creek Watershed and the Upper Willamette steelhead trout in Milk Creek, as these are appropriate indicators of watershed health.

The potential for cummulative effects to steelhead trout is based on the modeled concentrations of esfenvalerate in the water in Clear Creek, at the confluence with Swagger Creek, and in Milk Creek, at the confluence with tributary 10b, draining Section 23. In each sub-watershed, two concentrations were modeled. The first is the concentration during mid-winter (January) since this is the most probable time that runoff could occur with any modeled concentrations of esfenvalerate. These cummulative concentrations are based on the modeled field concentrations assumed to leave the treatment fields diluted by the estimated mean daily winter flows in either Clear Creek or Milk Creek. The second concentration is based on the peak modeled springtime concentration of esfenvalerate assumed to leave the treatment fields diluted by the estimated maximum daily spring flows in either Clear Creek or Milk Creek. This springtime concentration is used to determine effects to eggs in gravel (See also Effects on Fish).

The units modeled and the associated watersheds are identified in Tables 13 & 14. This modeling analysis has included all past applications of esfenvalerate at the seed orchard (see Table 15). Future application will be analyzed and impacts disclosed in the EIS. The values predicted are below the no effect thresholds for salmonid embryos. This is without accounting for the significant buffering capacity of the riparian zones.

Table 13 Past Esfenvalerate Spray Projects by Orchard Unit

Orchard Unit	Year of Spray
P11, P13	1999
P30, P33	1999, 2000
B34	1999

Table 14 Cumulative Effects Scope for Modeling Proposed Esfenvalerate Treatment Acres

Orchard Units	Orchard Section	Drainage	Net Acres Treated	Sub Watershed Size (acres)
P11, P12, P13, B14, B34	Section 13	Clear Creek	22.04	21,108
P30, 33	Section 23	Milk Creek	7.6	5,309
			TOTAL 29.64	

Table 15 Modeled Concentrations of Esfenvalerate (Asana XL) in Clear Creek and Milk Creek

Watershed	Flow period	Modeled Field Runoff Concentration	Modeled Concentrations at Sub-Watershed Outlet (mg/l)
Clear Creek	Winter Mean Daily Flow	Max Peak Concentration for 5 Year Climate Period	0.00000155
Clear Creek	Spring Max Daily Flow	Max Peak Concentration for Spring Period	0.000000902
Milk Creek	Winter Mean Daily Flow	Max Peak Concentration for 5 Year Climate Period	0.00000000178
Milk Creek	Spring Max Daily Flow	Max Peak Concentration for Spring Period	0.00000329

Summary of Impacts to Water: No new roads, no ground-disturbing activities, and no vegetation changes will be done as part of the proposed action. The action involves aerial spraying for insect pests in established plantations. Impacts would be limited to the action of the insecticide to be sprayed. Based upon the breakdown behavior of esfenvalerate, soil and organic matter adsorbtion, and the design features (e.g buffers and measures to prevent spray drift and surface water from reaching the aquatic system) incorporated into the proposed action, there is low risk that esfenvalerate will be delivered to waterbodies in the orchard in concentrations which may impact beneficial uses.

Effects on Fish

Alternative 1 - No Action

Because esfenvalerate application would not occur under Alternative 1, there would be no risk of entry into surface or groundwater. Therefore, there would be no effects to any fish species.

Alternative 2 - Proposed Action (Aerial Esfenvalerate Application)

Streams 8 and 9a
The closest intermittent channel associated with stream 8 is approximately 800 feet from Orchard units P-30/33. There is no surface drainage from units P-30/33 to stream 8. Since the spray treatment is expected to occur under calm wind conditions there should be no drift contamination to stream 8. No impacts to cutthroat trout, if present in stream 8, are expected.

The closest intermittent channel associated with stream 9a is approximately 1000 feet from Orchard units P-30/33. There is no surface drainage from units P-30/33 to stream 9a. Since the spray treatment is expected to occur under calm wind conditions there should be no drift contamination to stream 9a. No impacts to cutthroat trout in stream 9a are expected.

Streams 2, 3, 5, 6, and 10
Drift: Past monitoring has indicated that if esfenvalerate is applied under calm conditions there should be little drift of the spray. Nearly all nearby streams are buffered with natural vegetation, including a relatively dense overstory of conifer and hardwoods. A 200 foot buffer on stream 2a/b will reduce the potential for drift to enter that stream. Due to the design features it is not expected that esfenvalerate will reach any stream channels as a result of drift.

Surface Water: The potential for esfenvalerate to runoff or leach into surface waters was modeled using the Groundwater Loading Effects of Agricultural Management Systems (GLEAMS) model. The model is not able to predict chemical concentrations reaching streams which are separated from the target fields by buffer areas. All of the live streams at the seed orchard have dense riparian buffers which range in width from around 50 ft to several hundred feet, with the exception of stream 2a. Design features for stream 2a/b, including a 200 foot buffer, should reduce the potential for contaminated runoff to enter stream 2a/b. It is likely that any esfenvalerate that enters the riparian buffers will bind with the soil and organic matter in the buffer and will not reach the stream channel. Since GLEAMS cannot model the fate of the chemical within these buffers, a conservative approach was taken and it was assumed that the concentration of esfenvalerate leaving the fields was the amount entering the streams. Because the on-site conditions and the riparian buffers preclude direct runoff from the treated fields into the streams, along with the design features included with the proposed action, the modeled concentrations of esfenvalerate in the streams predicted in the risk assessment (Tables 16 and 17) are likely to be higher than actual concentrations.

The potential for effects to steelhead trout is based on the modeled expected exposure concentrations (EEC) of esfenvalerate in the water in Clear Creek, at the confluence with Swagger Creek, and in Milk Creek, at the confluence with the tributary (Tributary 8 on Map 6) draining Section 23. Steelhead are not known to use any of the tributaries of Clear Creek or Milk Creek that enter the seed orchard. Two concentrations were evaluated. The first is the concentration in Clear Creek or Milk Creek during mid-winter mean flows since this is the most likely time that peak concentrations of esfenvalerate might enter the streams. The concentrations are based on the peak winter concentration of esfenvalerate leaving the treatment fields diluted by the estimated mean winter flows in either Clear Creek or Milk Creek. These EEC's were compared to the LC_{50} (0.0003 mg/l) for rainbow trout (EXTOXNET). The second concentration evaluated is based on the peak spring-time concentration of esfenvalerate leaving the treatment fields diluted by the estimated mean spring flows in either Clear Creek or Milk Creek. The spring-time exposure concentration was used to estimate the concentration that maybe in the water when eggs may be in the gravel. The spring-time EEC's were compared to the LC_{50} for rainbow trout and the LC_{50} (0.00009 mg/l) for 6-day steelhead trout embryos/fry (Curtis, et al. 1985).

To determine the potential for effects to cutthroat trout, the EEC's of esfenvalerate in four tributary streams (streams 2, 3, 5, 6) to Swagger Creek and stream 10 to Milk Creek were calculated. Stream 2 is not fish-bearing within the orchard. It is assumed that cutthroat trout are likely to occur in the vicinity of the reservoir that stream 2 drains into (the reservoir is on private land and no surveys have been done to determine where fish habitat ends). The LC_{50} values for rainbow trout and 6-day steelhead trout embryos/fry were considered to be representative for cutthroat trout since no data for cutthroat trout is available. The EEC's evaluated were those calculated to occur during maximum winter flows, when the peak concentrations of esfenvalerate might enter the streams, and the maximum spring-time flows, when cutthroat embryos/fry maybe present.

The estimated (modeled) risk was made using the Quotient Method (EPA 1986). Using this method, the ratio of the estimated exposure (EEC) to the exposure level expected to have an adverse effect (LC_{50}) provides the risk estimate. The quotient (Q) is assessed as follows:

$Q < 0.1$ = No adverse effects
$0.1 < Q < 10$ = Possible adverse effects
$Q > 10$ = Probable adverse effects

The modeled results of the risk assessment for steelhead trout and cutthroat trout are shown in Tables 16 & 17. Table 18 reflects effects expected with on-site conditions taken into consideration.

Table 16 Modeled Expected Exposure Concentrations of Esfenvalerate (Asana Xl) and Risk Assessment for Steelhead Trout and Steelhead Trout Embryos/fry in Clear Creek and Milk Creek for 2001 Horning Seed Orchard Spray Project Based on Gleams

Species/Life Stage	LC_{50} (mg/l)	EEC (mg/l)*	Flow Condition for EEC	Risk Estimate (Q)	Risk based on Modeled Field Runoff
Clear Creek					
Steelhead (rainbow trout)	0.0003	0.00000155	winter mean flow	0.005	No adverse effect
		0.000000902	spring mean flow	0.003	No adverse effect
Steelhead embryos/fry	0.00009	0.000000902	spring mean flow	0.01	No adverse effect
Milk Creek					
Steelhead (rainbow trout)	0.0003	0.00000000178	winter mean flow	0.00001	No adverse effect
		0.00000329	spring mean flow	0.01	No adverse effect
Steelhead embryos/fry	0.00009	0.00000329	spring mean flow	0.03	No adverse effect

*EEC = Expected Exposure Concentration

Table 17 Modeled Expected Exposure Concentrations of Esfenvalerate (Asana Xl) and Risk Assessment for Cutthroat Trout and Cutthroat Trout Embryos/fry in Swagger Creek and Milk Creek Tributaries 2, 5, and 6 for 2001 Horning Seed Orchard Spray Project Based on Gleams

Species/life Stage	Lc_{50}(mg/l)	Eec (Mg/l)*	Flow Condition for Eec	Risk Estimate (Q)	Risk Based on Modeled Field Runoff
Streams 2b & 3 (To Reservoir) (Swagger Creek)					
Cutthroat (Rainbow Trout)	0.0003	0.0000306 0.0000875	Winter Max Flow Spring Max Flow	0.10 0.29	No Adverse Effect Possible Adverse Effects
Cutthroat Embryos/Fry (Steelhead Embryos/Fry)	0.00009	0.0000875	Spring Max Flow	0.97	Possible Adverse Effects
Stream 5a (Swagger Creek)					
Cutthroat (Rainbow Trout)	0.0003	0.00000649 0.0000126	Winter Max Flow Spring Max Flow	0.02 0.04	No Adverse Effect No Adverse Effect
Cutthroat Embryos/Fry (Steelhead Embryos/Fry)	0.00009	0.0000126	Spring Max Flow	0.14	Possible Adverse Effects
Stream 6 (Swagger Creek)					
Cutthroat (Rainbow Trout)	0.0003	0.0000028 0.00000544	Winter Max Flow Spring Max Flow	0.009 0.02	No Adverse Effect No Adverse Effect
Cutthroat Embryos/Fry (Steelhead Embryos/Fry)	0.00009	0.00000544	Spring Max Flow	0.06	No Adverse Effect
Stream 10 (Milk Creek)					
Cutthroat (Rainbow Trout)	0.0003	0.0000508 0.0000972	Winter Max Flow Spring Max Flow	0.16 0.32	Possible Adverse Effects Possible Adverse Effects
Cutthroat Embryos/Fry (Steelhead Embryos/Fry)	0.00009	0.0000972	Spring Max Flow	1.08	Possible Adverse Effects

*EEC = Expected Exposure Concentration

Table 18. Revised Risk Assessment for Fish in Clear Creek, Swagger Creek Tributaries 2, 5, 6, Milk Creek, and Milk Creek Tributary 10 for 2001 Horning Seed Orchard Spray Project Based on On-site Field Conditions

Stream	Modeled Risk Assessment	On-Site Factors	Revised Risk Assessment
Clear Creek	No adverse effects to any life stage	Due to on-site factors for Swagger Creek streams 2b, 3, 5a, and 6 (below), the potential esfenvalerate concentrations in Clear Creek are expected to be at much lower concentrations than modeled.	No adverse effects to any life stage
Swagger Creek - Streams 2b and 3 (to reservoir)	Possible adverse effects to all life stages during spring max flows	Design features including 200' buffers along stream 2a/b, a silt fence at the head of stream 2a, and soil aeration will further reduce the potential for drift or runoff into stream 2a/b from Orchard units B-14, P-10, and P-12. Any potential contamination of stream 2a/b is expected to be at much lower concentrations than modeled. Orchard units P-11/13 are not connected with stream 3 by any surface channels. Any potential chemical runoff from the units P-11/13 is expected to go subsurface and be adsorbed to the soil and is not expected to reach flowing streams.	Possible adverse effects to cutthroat trout embryos/fry during spring max flows due to moderate potential for contamination to stream 2a/b
Swagger Creek - Stream 5a	Possible adverse effects to embryos/fry during spring max flows	Orchard units P-11/13 are not connected with stream 5a by any surface channels. Units P-11/13 and B-34 are separated from stream 5a by 160'-280' of riparian vegetation. Any potential chemical runoff from the units is expected to go subsurface and be adsorbed to the soil and is not expected to reach flowing streams.	No adverse effects to any life stage
Swagger Creek - Stream 6	No adverse effects to any life stage	The only potential surface channel connection between orchard unit B-34 and stream 6 is an ephemeral ditch along the road in the SW corner of the unit. The road separates the ditch from the orchard unit. This ditch will have a 100' buffer. Unit B-34 is separated from the nearest intermittent channel by a minimum of 201' of riparian vegetation. Any potential chemical runoff from the unit is expected to go subsurface and be adsorbed to the soil and is not expected to reach flowing streams.	No adverse effects to any life stage
Milk Creek	No adverse effects to any life stage	Orchard units P-30/33 are not connected with stream 10 by any surface channels. Units P-30/33 are located approximately 1700' away from the intermittent portion of stream 10. Any potential chemical runoff from the unit is expected to go subsurface and be adsorbed to the soil and is not expected to reach flowing streams.	No adverse effects to any life stage
Milk Creek - Stream 10	Possible adverse effects to all life stages during all max flows	Orchard units P-30/33 are not connected with stream 10 by any surface channels. Units P-30/33 are located approximately 1700' away from the intermittent portion of stream 10. Any potential chemical runoff from the units is expected to go subsurface and be adsorbed to the soil and is not expected to reach flowing streams.	No adverse effects to any life stage

Steelhead trout: It is not expected that there will be any adverse effects to steelhead in either Clear Creek or Milk Creek as a result of applying esfenvalerate in the seed orchard. The Q values (0.00001-0.03) for all modeled flows are all less than the 0.1

level for possible adverse effects. Additionally, the predicted Q values are considered to be conservative due to the inability of the GLEAMS model to account for the riparian buffers and because there is no hydrologic connection between several spray fields and the streams.

Cutthroat trout: Esfenvalerate may pose possible adverse effects to cutthroat trout in the Swagger Creek tributaries. The Q values (0.009-0.06) for stream 6 indicate that adverse effects to any life stage for cutthroat trout are not likely in this stream. The modeling for streams 2, 3, and 5 indicates that there is not likely to be adverse effects (range of Q = 0.02-0.1) to cutthroat trout during the winter high flow periods when the highest potential concentrations of esfenvalerate are likely to occur. However, there may be possible adverse affects (range of Q = 0.14-0.97) to cutthroat trout during the spring when flows are lower (less dilution) and when eggs maybe in the gravel. The highest Q values are associated with stream 2, which is non fish-bearing on the orchard, but has a moderate potential for contamination due to its close proximity to treated fields. There may be possible adverse effects to cutthroat trout embryos/fry in stream 5 according to the model, however the modeled concentrations of esfenvalerate in stream 5 are considered to be higher than would actually occur.

The model suggests that there is a potential for possible adverse affects to cutthroat trout in Milk Creek stream 10 (range of Q = 0.16-1.08). However, there is no hydrologic connection between orchard units P-30/33 and stream 10. Units P-30/33 are located approximately 1700 feet away from the intermittent portion of stream 10. Any potential chemical runoff from the unit is expected to go subsurface and be adsorbed to the soil and is not expected to reach flowing streams.

Scuplin within the Swagger Creek tributaries are likely to be affected in a similar manner as cutthroat trout.

Special Status Fish Species

Lower Columbia River and Upper Willamette River steelhead trout:
It is not expected that there will be any adverse effects to steelhead in either Clear Creek or Milk Creek as a result of applying esfenvalerate in the seed orchard. The proposed action "may affect, but is not likely to adversely affect" Lower Columbia River and Upper Willamette River steelhead trout.

Lower Columbia River and Upper Willamette River chinook salmon:
The proposed action will have no effect on Lower Columbia River and Upper Willamette River chinook salmon because their distribution is limited to the lower reaches of Clear Creek and Milk Creek, 12-15 miles downstream, respectively, from the orchard. Potential concentrations that were modeled for Clear Creek and Milk Creek would be considerably diluted by additional runoff from the rest of the watersheds and pesticide concentrations will decrease rapidly as the rivers flow downstream.

Columbia River chum salmon, Bull trout, and Oregon chub:
The proposed action will have no effect on Columbia River chum salmon, bull trout, or

Oregon chub because these species are not found in the Clackamas River or Molalla River drainages.

Southwestern Washington/Columbia River cutthroat trout:
The proposed action may result in adverse effects to cutthroat trout associated with Swagger Creek streams 2, 3, and 5 due to potentially high concentrations of esfenvalerate runoff during spring. Cutthroat trout eggs within stream 5 may incur possible adverse effects, Q=0.14, however the modeled concentrations are likely to be higher than actual concentrations since there is no hydrologic connection between orchard units P-11/13 and stream 5 and because there is a wide (160-280 foot) riparian buffer. The most likely potential source for contamination is from stream 2, which is non fish-bearing. However, design features are expected to minimize the potential for runoff from orchard units B-14 and P-10/12. Due to the close proximity of cutthroat trout to orchard units B-14 and P-10/11/12/13, the proposed action “may affect, and is likely to adversely affect”, but will not jeopardize, Southwestern Washington/Columbia River cutthroat trout.

Effects on Wildlife

Alternative 1 - No Action

Esfenvalerate would not be applied in this alternative. No affect on wildlife, including non-target insect species and their predators would occur.

Alternative 2 - Proposed Action (Aerial Esfenvalerate Application)

The birds and mammals that inhabit the Horning Seed Orchard could experience both direct (contact with spray) and/or indirect (consuming sprayed material-- plant or animal) exposure to esfenvalerate. This chemical is considered moderately toxic to mammals (USDA Forest Service 1995a), and test results regarding toxicity to birds varies from slightly to moderately toxic (Oregon State University 1996 and USDA Forest Service 1995b). Because of the application operation procedures planned for the proposed action, the level of exposures expected are far below the toxic threshold. In addition, there would be little potential for chronic exposure to wildlife. The remote exception to this may be that according to the USDA (1995b) there is evidence that esfenvalerate may bioaccumulate in the tissues of fish and other aquatic organisms. Birds and mammals that prey on these species could have chronic indirect exposure to esfenvalerate through consuming tainted prey, but laboratory studies show that low chronic exposure does not have significant adverse affects on laboratory rabbits or rats (USDA Forest Service 1995b). The spray procedures outlined in the proposed action have been designed to preclude or minimize contamination of any wet areas, streams, or open water where aquatic species reside.

Application of esfenvalerate may have an adverse affect on insect predators and non-target insect species including pollinators. According to the Pesticide Fact Sheet, esfenvalerate is highly toxic to bees (USDA Forest Service 1995b). Oregon State University (1996a) found that esfenvalerate can interrupt pollination by killing bees and effectively repelling bees from the sprayed area for up to two days after application. Toxicity is related only to direct spray and esfenvalerate is not expected to be toxic to bees after drying. Several design features specific to protection of bees are included within the proposed action (See Chapter 2). It is expected that implementing these design features would minimize any potential effect to bees that would result from esfenvalerate aerial application associated with the proposed action.

If esfenvalerate temporarily reduces the population of non-target insects in and around the orchards, the food supply for nesting insectivorous birds would also decline. They would have to forage elsewhere until the insect population has recovered. Because of esfenvalerate’s short duration toxicity to insects and the relatively small area that would be sprayed, it is not be expected that any reduction in vigor or productivity in these bird species would occur.

Because of their affinity to riparian areas, most resident amphibians and reptiles within the orchard are not expected to receive direct exposure to esfenvalerate, again because of the many design features of the proposed action. There is the potential of some direct or indirect contact with esfenvalerate to individual amphibians or reptiles within the immediate spray zone.

A complete risk assessment for non-target animals was completed for the Oconto River Seed Orchard in 1997 (USDA Forest Service 1997b). It included discussions on the toxicity and exposure of esfenvalerate on terrestrial and aquatic species. The protection measures, method of application, and the rates of application were the same as in the proposed action at Horning Seed Orchard. The interdisciplinary team reviewed the Oconto Risk Assessment and concluded that it can be tiered to in total for the esfenvalerate applications in the proposed action.

Conclusions in the Oconto FEIS were that exposures to esfenvalerate applied by aerial means were well below benchmark levels of concern. The only exposure above levels of concern was exposure to concentrated chemicals in a direct spill accident, which is highly unlikely and can be mitigated through normal safety and hazardous material procedures such as those included as design features of the proposed action.

No new roads, no ground-disturbing activities, and no vegetation changes will be done as part of the proposed action. The action involves aerial spraying for insect pests in established plantations. Impacts would be limited to the action of the insecticide to be sprayed. Based upon the breakdown behavior of esfenvalerate, soil and organic matter adsorbtion, and the design features incorporated into the proposed action, there is low risk that esfenvalerate will be delivered in the orchard in concentrations that would cause long term declines of resident and non-resident wildlife or bees.

Monitoring

The following monitoring requirements are included in the design features of the proposed action:

If rain has preceded the intended application window, units will be checked for their infiltration capacity. Application will not occur if soils are in a saturated condition.

Monitor temperatures carefully. Avoid spraying during the day when bees are active.

Drift of aerially applied chemicals will be monitored during the spray operations using 4" X 5 ½" spray cards to detect the presence of drift and the relative amount. Spray cards will be installed along the perimeter of the treatment area, approximately every 50 to 100 feet in sensitive areas such as along stream buffers. Application techniques would be altered or spray operations would cease if drift were detected.

Water quality monitoring for detectible concentrations of esfenvalerate will be conducted immediately before, and after the aerial spray. This will be done in channels 2b, 5a, and 6a. The results of this monitoring combined with the results from the spray cards should provide evidence of the immediate impacts from any potential drift. If there are any rainfall events which occur after the spray project that results in surface runoff (during the Spring season), sampling of runoff and sediment will be conducted with the intent of validating the esfenvalerate modeling and impact assessment. This data along with a proposed long term monitoring program will be included in the EIS.

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Consultation

In addition to the interdisciplinary team noted above, the following individuals or organizations were, or will be, consulted concerning this EA.

U.S. Fish and Wildlife Service
National Marine Fisheries Service
Neighbors adjacent to the orchard
Fran Philipek - Salem District Archeologist

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ACS (Aquatic Conservation Strategy) Objectives Tracking Form

Horning Seed Orchard Esfenvalerate Spray Project
EA No. OR-08-01-03

ACS Objective *	Does project retard or prevent attainment of this ACS objective? Yes or No	Remarks / References
1. Maintain and restore the distribution, diversity, and complexity of watershed and landscape-scale features to ensure protection of the aquatic systems to which species, populations and communities are uniquely adapted.	NO	This project will **maintain** the diversity and complexity of the watershed and landscape features since there will be no ground disturbing or vegetation disturbing actions associated with this project.
2. Maintain and restore spatial and temporal connectivity within and between watersheds. Lateral, longitudinal, and drainage network connections include floodplains, wetlands, upslope areas, headwater tributaries, and intact refugia. The network connections must provide chemically and physically unobstructed routes to areas critical for fulfilling life history requirements of aquatic and riparian dependent species.	NO	This project will **maintain** the spatial and temporal connectivity within and between watersheds. No new roads, no ground-disturbing activities and no vegetation changes will be part of the Proposed Action. There will be no change to drainage network connections including floodplains, wetlands, upslope areas, headwater tributaries. Design features have been included to minimize spray drift and the potential for contamination of streams from surface runoff. Modeled concentrations of esfenvalerate in streams are considered to be higher than actual concentrations would be due to the design features and existing network of riparian buffers. Any potential chemical runoff from the unit is expected to go subsurface and be absorbed to the soil and is not expected to reach flowing streams. It is not expected that concentrations of esfenvalerate in any streams would alter routes to areas critical for fulfilling life history requirements of aquatic and riparian dependent species.
3. Maintain and restore physical integrity of the aquatic system, including shorelines, banks, and bottom configurations.	NO	The action involves aerial spraying for insect pests in established orchards with established accesses. Impacts would be limited to the action of the insecticide to be sprayed. No new roads, no ground-disturbing activities and no vegetation changes will be part of the Proposed Action. This project will **maintain** the physical integrity of the aquatic systems within the Seed Orchard since there will be no ground disturbing or vegetation disturbing actions associated with this project. There are no stream channels within any of the units proposed for spray.
4. Maintain and restore water quality necessary to support healthy riparian, aquatic, and wetland ecosystems. Water quality must remain within the range that maintains the biological, physical, and chemical integrity of the system and benefits survival, growth, reproduction, and migration of individuals composing aquatic and riparian communities.	NO	This project will **maintain** water quality necessary to support healthy riparian, aquatic, and wetland ecosystems. No new roads, no ground-disturbing activities and no vegetation changes will be part of the Proposed Action. Design features have been included to minimize spray drift and the potential for contamination of streams from surface runoff. Modeled concentrations of esfenvalerate in streams are considered to be higher than actual concentrations would be due to the design features and existing network of riparian buffers. Any potential chemical runoff from the unit is expected to go subsurface and be absorbed to the soil and is not expected to reach flowing streams.

ACS Objective *	Does project retard or prevent attainment of this ACS objective? Yes or No	Remarks / References
5. Maintain and restore the sediment regime under which aquatic ecosystems evolved. Elements of the sediment regime include the timing, volume, rate, and character of sediment input, storage, and transport.	NO	This project will **maintain** the sediment regimes in the Swagger Creek and Milk Creek watersheds since there will be no ground disturbing or vegetation disturbing actions associated with this project.
6. Maintain and restore in-stream flows sufficient to create and sustain riparian, aquatic, and wetland habitats and to retain patterns of sediment, nutrient, and wood routing. The timing, magnitude, duration, and spatial distribution of peak, high, and low flows must be protected.	NO	The action involves aerial spraying for insect pests in established orchards with established accesses. Impacts would be limited to the action of the insecticide to be sprayed. No new roads, no ground-disturbing activities and no vegetation changes will be part of the Proposed Action. This project will **maintain** the flow regimes within all the streams associated with the orchard.
7. Maintain and restore the timing, variability and duration of floodplain inundation and water table elevation in meadows and wetlands.	NO	The action involves aerial spraying for insect pests in established orchards with established accesses. Impacts would be limited to the action of the insecticide to be sprayed. No new roads, no ground-disturbing activities and no vegetation changes will be part of the Proposed Action. This project will **maintain** the flow regimes, and hence the timing, variability and duration of floodplain inundation within all the streams associated with the orchard and will not affect water table elevation within or adjacent to the orchard.
8. Maintain and restore the species composition and structural diversity of plant communities in riparian areas and wetlands to provide adequate summer and winter thermal regulation, nutrient filtering, appropriate rates of surface erosion, bank erosion, and channel migration and to supply amounts and distributions of coarse woody debris sufficient to sustain physical complexity and stability.	NO	The action involves aerial spraying for insect pests in established orchards with established accesses. Impacts would be limited to the action of the insecticide to be sprayed. No new roads, no ground-disturbing activities and no vegetation changes will be part of the Proposed Action. The pesticide esfenvalerate will not affect vegetation, either in the orchard units or in the riparian buffers. All vegetation, in terms of species composition and structural diversity will be **maintained**.
9. Maintain and restore habitat to support well distributed populations of native plant, invertebrate, and vertebrate riparian-dependant species	NO	The treatment will take place mainly outside riparian reserves and the treatment within riparian reserves is minimal, thus it will have to impact on riparian dependent species or their habitat, and this objective will be **maintained** (BA p. 4, 21; EA p.12, 33, 36).

* (See Salem Resource Management Plan, May 1995, pages 5-6 for more detailed explanation of the ACS objectives)